JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCV., No. 2255.——TUESDAY, JULY 31, 1906.

EDITORIAL NOTES—GAS, &c.

Gaslight and Coke Company—Excellent Account.

To-day is commenced the review of the operations of Gas Companies during the past half year; and it augurs well for the duty being a continuously agreeable one that the first accounts which come to hand—as usual those of the Gaslight and Coke Company—expose results that are the most gratifying the Company have experienced for some time. Upon this there must be unstinted congratulations to the Governor (Mr. Corbet Woodall), his co-Directors, the proprietors, and last, but by no means least, the officials, who have been devoting themselves earnestly and energetically to business development. The results of their work, in a period that has not been over-favourable to an extension of gas consumption, are crystallized in the statement that "the "sales of gas for the half year show an increase of 3·94 per "cent. over those of the corresponding half year of 1905." This percentage increase is upon the sale of 10,450,895,000 cubic feet in the first half of 1905; and it represents an addition to those mammoth figures of no less than 412,060,000 cubic feet. Such figures accentuate the difference, in the case of a Company doing business of such magnitude, that even fractions of 1 per cent. increase or decrease mean to them in volume. The importance and gratifying character of the half-year's increase is further emphasized by recalling the fact that, in the corresponding period of 1905, there was a decrease of 1·8 per cent. in the sales, and in the second half of the year an increase of only 1·2 per cent. The past half-year's increase will be found to rank well with the advances of the other two Metropolitan Gas Companies. Our electrical contemporaries, who always take a keen interest in the affairs of the Gaslight Company, will not fail to observe that of the increase in consumption no less a quantity than 406,815,000 cubic feet is due to private business, and 5,245,000 cubic feet to public lights. Compared with June, 1905, the number of public lamps has only been augmented by 4; and as four public lamps cannot be responsible for an increase of 5,245,000 cubic feet in a half year, the explanation of the increase is no doubt to be found in the growing use of lamps of higher illuminating power. Municipal ownership of electricity undertakings in London results in the displacement of gas-lamps. But, nevertheless, gains in other directions, including displacements of electric lamps, maintain the total of the connections. The addition of 13,412 to the number of consumers, and of 14,379 to the number of stoves sold and on hire, is also highly satisfactory.

Financially the operations of the half year have also been good. In both of the account periods of last year, the earnings were insufficient to satisfy all dividend requirements, chiefly through a reduction of 1d. in the price of gas and poorer prices for residuals than those ruling in 1904. But as residuals only produced £2575 more in the past half year as compared with the first half of 1905, it is seen that the effect of the reduction in the price of gas has been completely eliminated and left well behind by the increase in consumption. The result is that, including the £181,298 brought forward, the available sum for distribution is £544,949; and, after paying a dividend at the rate of £4 8s. per cent. per annum, a sum of £210,481 will remain to be carried to the credit of the current half year. In other words, the undivided balance is restored to within £7000 of what it was twelve months ago. The revenue account, under the head of manufacture, will give the Governor, at the meeting next Friday, scope for some interesting explanation; for while such a largely increased business has been done, the total manufacturing expenses are merely £4515 more than in the corresponding half year. The amount spent on coal was only £4766 more; but on oil £5216 less was expended; so that on these two items there was a diminished expenditure of £450. Less was also expended on the coke and breeze used in the manufacture of carburetted water gas; and it is found that the production of carburetted water gas was smaller by 156,512,000 cubic feet than in the corresponding half of last year. This all points to improved coal carbonizing results—seeing that not only this difference in carburetted water gas production was thrown on to coal gas, but the increase in consumption, and yet less than an extra 24,000 tons of coal were carbonized. A noteworthy item is purification, upon which there has been a decline in expenditure of £11,614. On the repair and maintenance of the works and plant, little short of £29,000 additional has been spent.

Manufacturing charges are certainly worthy of special mention; but there is an indication that in the coming two half years the item for coal will not show up quite so well, as the annual contracts for coal have been made at prices "materially higher" than those of last year. The word "materially" is indefinite; but it suggests a substantial advance. In distribution, there has been an increase of between £4000 and £5000; and this has been expended almost entirely on repairs and maintenance. A very uncommon feature is a reduction of £2689 in rates and taxes; and no doubt this is to be traced to the expenditure in recent half years upon the quinquennial revaluations, for the rate poundage has not diminished sufficiently in any district in London to make all this difference. Management expenses have also declined; and, among minor items, there will be satisfaction over the few hundreds addition that are entered to annuities, superannuation, and compensation funds. On the revenue side, the increases of £56,909 in the sales of gas and of £2526 in stove-rental are especially gratifying. Residuals have produced £2575 more. The returns from coke have not been so good; but tar and tar products and ammoniacal liquor and sulphate have not only counterbalanced the drop on coke, but have brought about the excess. The result on the revenue account is a balance of £569,879, as compared with £509,223.

So far as the financial and working results are concerned, the pleasure of presenting and receiving the report and accounts will be mutual as between the Board and the proprietors. There are, however, sad passages in the report; for in it are conjunctively recorded the death of Sir William Makins and the resignation through ill-health of Mr. J. W. Field. The long connections of both with the concern, and their intimate relationships in its management, make these announcements the more impressive.

South Metropolitan Gas Company—The Last Reduction Recouped.

In 1904, the Directors of the South Metropolitan Gas Company reduced the price of gas to a figure that had never before obtained in the case of a London Gas Company—viz., to 2s. per 1000 cubic feet; and that price the consumers have continued, and still continue, to enjoy, at the expense of the absorption of the greater part of the Company's undivided balance, and the difference between the very good dividend of 5½ per cent. and the higher one to which the proprietors have been statutorily entitled. The Company are in a strong position in connection with their reserves; and it was possibly this fact that allowed the Directors and the proprietors to look upon their dwindling undivided balance with stoical equanimity. We do not remember, in fact, ever having heard a single complaint over the deficiency of earnings. The drop has been made to 2s.; and 2s. gas in this Company has come to stay, if the sale and purchase markets will permit. A penny reduction represents to the Company, roundly, £50,000 a year; and since the reduction was made three half years ago, the deficiency in earnings has totalled to £52,398. But there has been a gradual gain on the direct loss caused by the reduction; and at the meeting to-morrow week,

Sir George Livesey will have the felicity of announcing that the increase of business—though the residuals have receded somewhat from the returns of the corresponding period of last year—has at length succeeded in overtaking the loss of revenue produced by the reduction, and that there is the small sum of £267 to be carried forward to the almost depleted undivided balance. This is highly satisfactory, and a matter for congratulation.

From this point of view alone, or taking the report and accounts as a whole, they must be pronounced gratifying. Reductions in the price of gas do not, in view of the counteracting effect of the spread of incandescent gas-burners, expedite consumption in the manner of pre-incandescent days; and, taking this into consideration, the increase of 3 per cent. in the consumption of the past half year, as compared with the June half of 1905, will be regarded as good. Another feature of the Directors' report—and it is a potent one for the future—should be bracketed with this increase in consumption. It is the excellent strides that continue to be made in opening up new consumption outlets. It is true that the ordinary consumers show a small retrogression—506—when compared with twelve months ago. But the total is 102,169; and several of the consumers who have disappeared from the ordinary register have no doubt not been lost but transferred, for good and sufficient reasons, to the roll of slot consumers. The latter consumers, however, present a remarkable set-off against this comparatively slight decline; the increase, compared with the figures for the corresponding half of last year, being 16,007. It was thought a wonderful aspect of modern gas supply when the number of prepayment consumers began to equal that of the ordinary consumers. But in the accounts before us, with the fresh addition, the number of slot consumers nearly doubles the ordinary—standing at 198,080; and, with the coming winter's accretions, before the closing of the next accounts we shall look for the "slots" having exceeded a doubling of the "ordinaries." The same satisfactory features are found in connection with stoves. The increase in ordinary consumers' cooking-stoves, compared with the first half of 1905, is 2863 (total 71,501); and in cooking-stoves connected with prepayment installations it is 10,702 (a total of 167,242). It is a matter of interest to note that, though the slot consumers nearly double the number of the ordinary, there are only 30,838 without cooking-stoves, which is about the number of ordinary consumers who are also still without them (30,668).

The accounts do not invite much comment. The increase in the make of gas in comparison with the first half of 1905 was 98,345,000 cubic feet—making the total 6,428,595,000 cubic feet; while the quantity of additional coal carbonized was only 2687 tons. There has been a decided gain in the average make of gas per ton—something like 130 cubic feet, which, on such a total as 586,950 tons of coal, represents a not inconsiderable advantage to a half-year's working. This improvement is very satisfactory considered in connection with the co-partnership scheme; and it does not tell the whole tale. For not only has there been an increased quantity of coal handled and more gas made per ton, but the carbonizing wages amount to £1701 less than in the six months of 1905 with which comparison is made. On the other hand, for the past twelve months co-partnership has cost £43,962 (being at the rate of 9¾ per cent. on salaries and wages), or £870 more than in 1905. This £870 it must be conceded, on the facts presented by the accounts, the men have fairly earned. Another item under the head of manufacture which will be looked upon with interest, is purification. As in the case of the Gaslight and Coke Company, it has diminished considerably; standing in these accounts at £13,747, which is a reduction of £7385 as compared with the item in the corresponding period last year. The expenditure for coal shows the beginning of the return to higher prices; for while only 2687 tons more coal were carbonized, the cost increased by nearly £8000. In the report, Sir George Livesey and his colleagues again appeal to buyers of gas coal not to submit, as they have done in the past, to any extravagant demands made by coalowners. The price, however, in the case of the South Metropolitan Company, has gone up "materially," as in the case of the Gaslight and Coke Company; and insight is afforded here as to what the rise meant. "Putting coal and freight together, the "extra cost to this Company for twelve months' supply will "probably amount to £60,000;" and £60,000 about equals in shillings the tons of coal carbonized by the Company in the past twelve months. In view of this, there will be some curiosity as to what Sir George will have to say at the meeting of proprietors about the prospects of maintaining the present price of gas under the changed conditions. The requirements of capital, as we have seen, have been just about met from the balance of the past half year. The undivided balance has been almost entirely handed over to the consumers; and the Company have to face (true, with good reserves) an extra expenditure during twelve months of about £60,000. Certain it is that the South Metropolitan Company will hesitate before departing from that convenient and popular two-shilling price, unless inner knowledge of their prospects impels.

Concerning the revenue of the half year, the sale of gas for private purposes brought in £603,855, which is an increase, compared with the first half of 1905, of £16,184, and something like two-thirds of this was obtained in the three months of the half year. Meter and stove rents also brought in £3138 more. In residuals, the figures exhibit a contrary experience to those of the Gaslight and Coke Company. Coke was the only bye-product upon which the latter Company have a decrease; it is the only one on which the South Metropolitan have an increase, and that increase is £1897. Deducting this from the decreases on the other items, there is a total diminution on residuals of £7868, compared with the first half of last year. Concerning tar, Sir George makes use of the report to once again urge upon gas makers to sell as much of that commodity as possible for fuel and road making at contract prices everywhere. At the forthcoming meetings throughout the country, opportunity might be taken of referring to the subject, in order to give it as great prominence as possible. The balance on the Company's revenue account is £207,635, which is better by £11,075. The half-year's statement has certainly many interesting parts; and the proprietors cannot fail to look upon it—considering all the circumstances and the low price of gas—with every satisfaction.

At all forthcoming meetings of gas shareholders, Chairmen will be doing a service to the gas industry and to investors by warning the latter against putting money into new gas concerns, or being entrapped by attractively drawn circulars or booklets, without making strict and independent inquiries as to the actual prospects of the undertakings.

Meeting of the North British Association.

WHAT was termed by the President—Mr. W. B. M'Lusky, of Perth—a record gathering of members graced the proceedings of the North British Association of Gas Managers at their annual general meeting in Edinburgh on Thursday. The large attendance may be partly due to the fact that it is six years since the Association last met in the city, and members may have been anxious to renew their acquaintanceship with it. But we must look for a deeper reason; and that is doubtless to be found in the fare which was promised, both of the technical and the entertainment order. To begin with, it was to be anticipated that the President would give an address which would be conspicuous for its applicability to the advanced thought of the times. That expectation was fully realized. Mr. M'Lusky clearly has the faculty of taking a view of gas matters which, in the political world, would be characterized as statesmanlike, which, in other words, means that his vision is not obscured by the gate of his own works, nor, indeed, by the horizon within which are grouped the present-day public questions relating to the gas industry. His mental view extends far beyond these; and his utterances are valued by his brethren for the element of guidance which they find in them.

But the contribution to the proceedings which will go farthest to make the meeting remembered in days to come, was the paper on "Illuminating Power and Lighting "Efficiency," by Mr. W. R. Herring, of Edinburgh. Such binding together of the conditions under which the testing of gas has been, and is being, carried on, and exposure of the absurdities and anomalies of the present practice, have seldom been seen. These would alone have made a sufficiently interesting paper for discussion. The communication is further considered in another column. The papers by Mr. T. Lighbody, of Renfrew, and Mr. J. W. Napier, of Alloa, dealt with constructional questions—valuable to the practical man more than to the scientist. They were full

of detail; and, consequently, instructive. For the ordinary member, they formed a balance to the deeper subject dealt with by Mr. Herring, and provided food for study for the large class of members who are not in a position to investigate the complex problems of chemistry.

Apart from the technical part of the meeting, there was a good deal in the general proceedings which was of more than usual interest. The first noticeable item was the announcement by the President of messages of apology for absence from representatives of English District Associations of Gas Managers—one even from the ex-President of the Institution of Gas Engineers itself. Such a wooing of Scotland by their English brethren was never seen before. But none of the gentle wooers presented himself in person; so it was a case of love at a distance. As a consequence, whether the blandishments of the Southron were reciprocated was necessarily not made clear. We can only form an opinion upon this subject from what took place. This is found in the proposal made to change the name of the North British Association to that of the Scottish Institution of Gas Engineers. This looks like a rebuff; but was it? In submitting the proposal, the ominous words were used that the change would strengthen the Bond of Union; and there was a faint foreshadowing of possibilities in the remarks that they probably somewhat hurriedly closed the door against affiliation, and that the change of name would get rid of the "odious term" of "District Association." From all this, it would appear that the Scotsmen are prepared to be conciliatory, and that, if proper terms were offered to them they might—as their legislators did in 1707—unite with England, and form one United Kingdom in the gas profession. In such an event, we should cherish the hope that the union would be as productive of good to both the parties—particularly to the smaller of the two—as was the greater union 200 years ago. The Scotsmen are admittedly in favour of a federal union. Let this be accepted, and the question of an incorporating union may be left over.

Another proposal before the meeting was that a Commercial Section should be formed, to assist in the control of markets. It was very cleverly put by the proposer, Mr. Laurence Hislop, as intended to prevent the cross-carriage of residuals. Were this all the effect to be produced, it must be remembered it would be to the advantage of the consumer; and the interest of the producer is not so manifest. Coke, we presume, was the substance chiefly aimed at. As to that, any reference to what is done in England is of little value, because here the coke is practically all of one quality. The same cannot be said of Scotch coke; and therefore any organized scheme for the distribution of that coke would be liable to break down, because there would be the danger that certain manufacturers, if they found they could not get the coke they wanted, would bring in some from England, and thus the Scotch trade would be paralyzed. This is a consideration which the Committee to whom the matter has been remitted would do well not to lose sight of. There is the further danger that the biggest poachers in the coke line might refuse to enter the combination, and form another section, in which event the last position of the coke market might be found to be worse than the first.

Illuminating Power and Gas-Testing in Scotland.

Some notable things have been done by Mr. W. R. Herring in his time; but not the least possessing that characteristic has been the persistent attack that he has been making, since he has gone North, on the unnecessarily rich gases, which do not render the best service to the consumers, that are supplied in Scotland, partly owing to the availability of cannel coals, and partly to a staunch adherence to conventionality. That the supply of these over-rich gases is a mistake, in the interests of the consumers, in these times of variable use and incandescent gas-burners, was recognized by at least one leading gas practitioner across the Border before Mr. Herring took the matter in hand. The late Mr. William Foulis succeeded in getting Glasgow to drop from that common standard of 25-candle gas tested in a flat-flame burner, to an 18-candle gas similarly treated to assay its illuminating power. Mr. Foulis's act in driving well into the illuminating power fallacy (though not quite home) the wedge that effected an irreparable cleavage of age-bound ideas, has a strong adherent in Mr. Alexander Wilson, who will not fail to follow, when the opportunity is favourable, along the line opened up by his predecessor and former chief. What has been done in the West of Scotland, Mr. Herring has firmly set his mind on doing in the East, as his various reports on the subject have revealed. His championship, however, has been stripped of purely local significance by the paper which he read before the North British Gas Association last week, on "Illuminating "Power and Efficiency;" and he has, in that paper, given a strong case—based, framed, and braced by scientific investigation—in favour of the supply of a permanent gas in place of one so overburdened with hydrocarbons that changes in atmospherical condition affect their stability or otherwise. It is a case that merits the fullest consideration of Scotch administrators. Of one thing we are confident, that it will not fail in giving another shock to the opinions of the votaries of gas of high luminosity; and that is one of its purposes.

The paper really had two objects. The first was the one referred to, of doing something to assist in the demolition of the error of high illuminating power gas; the second, to advocate that the reasonable method of testing that has been applied to the testing of gas not only in the Metropolis, but, as gas undertakers come before Parliament, in the Provinces, should be also applied to Scotland. Through the richness of the gas of Scotland, there has never been a real standard burner there such as there has been in England; and this has manifestly exposed the gas to unfair measurement. Gas, no matter what its quality, ought to have, in subjecting it to a qualitative examination, the credit of its highest possible duty; and any method that does not give it that, is unscientific, and is open to inconstancy and abuse. The whole system of testing gas in Scotland, in order to get to anything like comparatively uniform results, requires overhauling; and Mr. Herring's experience cannot suggest anything more fitting than the application of the "Metro-"politan" No. 2 burner, which is eminently suited for all gas up to (say) 20-candle power, but above that illuminating power there would have to be some variation of the 5 cubic feet rate of consumption. Perth has already given a lead to the adoption of the burner, through the application of the new model testing clause; and Mr. Wilson, it will be remembered, announced, at the last meeting of the Institution of Gas Engineers, that the "Metropolitan" No. 2 was the test-burner they have set their eyes upon in Glasgow.

Perhaps the most interesting part of Mr. Herring's paper is that in which he deals with the relationship, or rather want of relationship, that exists between the luminosity of gas and the duty obtained from incandescent gas-burners. Mr. Herring has been devoting some six years to investigating the phenomena which combine to make up the efficiency of the light emitted by an incandescent burner; and his work has, the paper shows, been most fruitful, even, we imagine, beyond Mr. Herring's expectations. There is one general conclusion to be drawn from the investigation, that it is neither luminosity nor calorific power alone that accounts for the efficiency of the gas when burned in an incandescent burner. In addition, there must be flame volume—a volume of flame sufficient to envelop every fibre of the mantle—for without this neither calorific power nor flame temperature can play its part and develop the highest degree of luminosity in the mantle. In the discussion, the members fully comprehended Mr. Herring's expression of flame volume; but Mr. Vass was anxious for some information as to how to arrive at the requisite volume. Mr. Herring left this point unsettled in his reply. It is one that needs a considerable amount of inquiry; for variable compositions of the gas, and other conditions, will affect flame volume. However, if the tables are studied, they will be found extremely instructive—more especially the last one, which records the results of tests demonstrative of the futility of high flame luminosity and calorific power alone in realizing the highest efficiency with the incandescent burner. Take the highest and lowest candle-power gas from the table, and this will be seen: A 20·32-candle power gas, of 667·7 B.Th.U. gross, returned a duty, in a "C" incandescent gas-burner, of 30·59 candles per cubic foot, and a 15·35-candle gas, of 589 B.Th.U., a duty of 30·47 candles per cubic foot. Practically there is no difference in the duty obtained. The latter, however, is a remarkable efficiency for 15·35-candle gas at 15-10ths pressure; and there is something about the figures that is inexplicable. Yet it is confirmed by the other tests. It is far and away the best result that we have come across under like conditions; and, at this rate, the question arises: Why trouble about high-pressure gas lighting, or specially constructed lamps, if Mr. Herring

can tell us how to get such a duty from a "C" burner, at ordinary district pressures? The paper has introduced fresh considerations into the question of illuminating power; and, to employ the author's own words, "nothing could be more "conclusive" than the contents of the paper "as to the "incorrectness of the policy of continuing to supply gas "judged by its luminous flame value."

The Irish Exhibition.

Preparations for the holding of the Irish International Exhibition in Dublin next year are being pushed forward with praiseworthy energy; and in the attention that is being devoted to it, the Gas Section is not behind the other portions. In last week's "JOURNAL," when recording the visit of a large number of interested persons to the exhibition buildings to see the progress of the undertaking, we reported some remarks made on the occasion by the Chief Executive Officer (Mr. James Shanks). After pointing out that the makers of electrical plant had not so far shown themselves to be quite alive to the advantages of the exhibition, Mr. Shanks acknowledged that the same thing could not be said of the gas contractors, who it was expected would (through the exertions of Mr. Francis T. Cotton, the Secretary and Manager of the Alliance and Dublin Gas Consumers' Company) fill a building, to be specially constructed for their occupation, with all varieties of gas appliances for lighting, cooking, and heating. In the advertisement pages of to-day's issue, there will be found reproduced a plan of the Gas Exhibits Pavilion. This shows the spaces available, both for exhibitors who require to use gas and those who do not. There is also a copy of a circular-letter which Mr. Cotton addresses to gas contractors, and which is important to all those contemplating taking part in the exhibition. With reference to the allotment of space, it may be pointed out that, though priority will be given to applications which come to hand on or before Aug. 8, the various applications received for space will not be dealt with before that date—that is to say, in fairness to all gas exhibitors, no space will be allotted before then. Prospective exhibitors will be glad to hear that the buildings are going on rapidly, and that they are extremely handsome. Now as to those who have not so far made up their minds to take an active part in what promises to be an excellent business opportunity. There is still time to decide on exhibiting, but not very much to spare, if the application is to be considered with the first batch. Diligence therefore should be exercised in the matter. As an additional inducement to exhibit, attention may be drawn to Mr. Cotton's announcement that since the meeting of contractors in London (which was duly reported in the "JOURNAL"), the Alliance and Dublin Company have decided to increase the discount on gas supplied to exhibitors from 25 to $33\frac{1}{3}$ per cent. Finally, we would remind readers that any gas contractors who have not yet received particulars—*i.e.*, copies of the prospectus, the form of application for space, and the plan of the Gas Section with instructions as to application for space—should communicate with Mr. Francis T. Cotton, at the Gas Company's Offices, D'Olier Street, Dublin; and he will promptly rectify the omission.

Utilization of Tar for Road Surfaces.

Since the reference by Sir George Livesey, at the annual meeting of the Institution of Gas Engineers, to the possible improvement of the market for tar by encouraging the use of this material for improving the surface of roads, evidence has been afforded that the matter is receiving attention in various parts of the country. The disposal of tar is a subject in which managers of gas-works are just now specially interested; and therefore Mr. D. W. Tooms, of Fermoy, did good service in bringing it forward at the meeting of the South-East of Ireland Association last week, a report of the proceedings at which will be found in another column. He showed that, besides burning it, there are various ways of utilizing tar on gas-works; and he gave particulars of what he is doing at Fermoy. Coming to the question of tarring roads, he pointed out that if, as the result of increased motor traffic, this treatment of the highway became general, it would necessarily mean that a large quantity of tar would be taken off the market. He therefore thought that experiments in this direction should be encouraged. Mr. Tooms was evidently voicing the opinion of his Directors, for he stated that they had offered to give to each of any six Irish County Surveyors 1000 gallons of tar, on their undertaking to experiment with it on road improvement. This, as he remarked, is the right spirit in which to deal with the problem. The trials should be carried out systematically, and the results published at their conclusion; for they would be interesting additions to particulars which are now accumulating. As mentioned in the report of the Royal Commission on Motor Cars issued last week, road authorities in several parts of England have experimented on short lengths of road with tar, "tar-mac"—a material consisting of iron slag broken small and boiled in tar—westrumite, and other dust preventives; but the trials have not been on a sufficiently large scale, or carried on long enough, to afford any satisfactory information as to their success or cost. The Commissioners are therefore unable to express any definite opinion on the score of economy. This, however, will have to be pronounced sooner or later, for the motor will be very much with us in the future; and perhaps gas makers may be able, by the adoption of some such course as that taken at Fermoy, to contribute reliable, and therefore useful, statistics on the subject.

Plymouth Town Councillors Surcharged.

A commotion has been caused among the Plymouth Town Councillors by the result of the first Local Government Board Audit of the municipal accounts. As was to be expected, the Auditor has found that certain things the Council have been doing are wrong; and the members of the Council are surcharged for expenditure which he holds to have been illegally incurred. One of the things, it appears, which the Council ought not to have done was to remit payment of a fine of £5 which, under the standing orders, Sir Joseph Bellamy incurred on resigning his membership of the Corporation a year or so ago. The remission of the fine was intended by the Council as a mark of appreciation of the good service which the Chairman of the Gas Company rendered to the town for many years; but the Auditor's opinion seems to be that the Council are bound by the letter of the regulations, and are not entitled to show any courtesy for which there is not direct legal sanction. However, Sir Joseph has relieved the Council of any embarrassment in regard to the matter by paying the fine. Other surcharges relate to expenses incurred by Councillors in attending certain meetings. A good deal was said about the absurdity of surcharging such expenses, while allowing those of deputations to London and other places. Logic is the last thing to be looked for in the regulation of English public affairs; and if the Auditor's decisions do not square on all points, probably he would say that is the law's concern and not his. It remains to be seen whether the Loca Government Board will uphold his decisions. Some of the Councillors who had been surcharged were so annoyed at the indignity which has been put upon them and municipal institutions, that they vowed they would never appeal. Others talked of passive resistance. The audit, it must be confessed, has not revealed any glaring illegalities. Those who are opposed to it contend that it unnecessarily and arbitrarily acts in restraint of the liberty of local government. On the other hand, it would seem to be evident that it will tend to make members careful as to the nature of the expenditure they incur. Whether this is the same thing as preventing extravagant expenditure, is doubtful. The London County Council and the Metropolitan Boroughs are not exactly models of economical administration; yet they are all subject to an auditing of accounts similar to that which has excited so much feeling at Plymouth.

Serious Gas Explosion near Holborn.—About three o'clock yesterday afternoon, an explosion occurred in May's Yard, Holborn, by which one man was killed, and two workmen, a woman, and two children injured. It appears that some men from the Gaslight and Coke Company were putting down fresh mains in Eagle Street, and three were at work in the yard. The explosion wrecked a building consisting of a dwelling-house and stables. The occupants of the former were the family of a man named Hobson, in the employ of Messrs. May, cartage contractors. Mrs. Hobson and one of the gas men were removed to King's College Hospital, her two children, and the other workman, whose injuries were rather serious, to the Homœopathic Hospital. It was some two hours after the explosion that the dead body of the man, who was one of the Company's workmen, was found among the ruins.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 341.)

THINGS on the Stock Exchange last week were not so bad as the week before, though that is not a high standard of praise. The opening was very flat on the suppression of the Russian Duma, though opinions differed as to the value of that body. But it meant another upset, and a fresh start of some sort, with great possibilities for mischief; so down went prices freely. Next day, however, showed a turn for the better. Consols were stronger; and the fall in Russians was checked. Thus gradually calmer views prevailed; and thenceforward up to the close of the week no fresh disturbance appeared. Business was, of course, very limited, especially as it was account week. The settlement was not a heavy one; but it was more than one or two parties could negotiate successfully. In the Money Market, there was at first a fairly strong demand; but with an abundant supply, rates eased off materially. Discount was pretty firm, but was inclined to be easier by the close. Business in the Gas Market was decidedly quieter—on one or two days particularly so. The tendency was a marked contrast to that of the previous week; for there seemed to be a rush to realize on the sharp advances then scored. At least, that was how it looked in Gaslight and Coke ordinary, which had changed hands at 102 on the Friday, and was now marked down on Monday to 99¼. On Wednesday and Thursday 98¼ was touched; but after that it rallied a little bit, and 99½ was marked on Friday. The fall in the quotation was two points. Not much was done in the secured issues. The maximum changed hands at 88¼ and 89½; the preference at 110½; the debenture at from 86 to 87¼. South Metropolitan held its position firmly, but was very little dealt in. Prices marked were good; ranging from 132½ to 133½. The debenture was done at 87¼. Commercials were almost wholly neglected; one bargain in the 4 per cent. stock at 115½ being all the business. In the Suburban and Provincial group, there was scarcely any business; and nothing of any interest. British changed hands at 42¼, Brentford new at 203½, Brighton original at 232, and West Ham debenture at 104. Among the Continental Companies, there was moderate business in Imperial, which was at first rather uncertain, and was done at 178 on Wednesday; but it improved later, and marked 180 on Friday. Union was done at 123¼ (a fall of 1 in the quotation). In Europeans, the fully-paid was done at 25 and 25¼, and the part-paid at 19, both *cum div.* Tuscan was done at 10⅜ and 10¼. Among the undertakings of the remoter world, Buenos Ayres changed hands at from 11½ to 11 13/16, Primitiva ordinary at 6½, ditto preference at 5 5/16 *cum div.* and 5⅜ *ex div.*, ditto debenture at 96½, River Plate at from 12⅜ to 12 7/16, with several transactions, ditto debenture at 97¾, Cape Town at 16⅛, ditto debenture at 53, and Melbourne 4½ per cent. at 104.

The closing prices are shown in our Stock and Share List on page 341.

ELECTRIC LIGHTING MEMORANDA.

Edinburgh and Depreciation—Power Supply Companies and Depreciation—Some Public Lighting Notes—From the North to London, and London to the North—The South Wales Power Company in Distress—Mr. Merz's Prescription.

THERE has been another tussle in the Edinburgh Town Council over the question of the disposal of the electricity profits. The advice of experts was taken, but not acted upon, which is not an uncommon occurrence in such disjointed bodies as municipalities, in which individual interests and ideas can never be got to hinge well together. It is the decided view of Sir Alexander Kennedy and the Resident Engineer (Mr. F. A. Newington) that the reserve fund should be made up to the statutory 10 per cent., and a depreciation fund established equal to 5 per cent. The Electric Lighting Committee are of the same opinion as their expert advisers; but the Council, as was seen a few weeks since, are against them. Mr. Stevenson, the Convener of the Electric Lighting Committee, takes the common-sense view that it is a pure misuse of the term "surplus" to so describe profit before the reserve fund has been built up to its maximum. The Electric Lighting Committee have made an excellent stand in defence of their profits being used for promoting the strength of the concern. Failing the consent of the Council to following the advice of the Engineers, the Committee last week came up with a proposal that, of the £16,361 of profit remaining for disposal from last year's profits, £10,000 should be placed to the credit of the reserve fund, and £5000 should be utilized in the reduction of the capital debt—leaving £1361 to be disposed of as the Council might direct. But the matter resolved itself into a contest between the Treasurer and the Committee; the former proposing, as an amendment, that £4000 should go to the relief of the rates and £12,361 to the reserve fund. Stability and economic finance have to bow to a transient pleasing of the popular fancy. A singular suggestion was made by the Treasurer in the course of the debate. On the question of depreciation, it was remarked by one speaker that electricity meters have fallen to about half the original value, at which they still stand in the books. The Treasurer counterbalances such depreciation by pointing to the fact that copper which cost the Corporation £40 to £45 per ton was now quoted at something like £90. This is pure sophistry; as whatever the figure at which copper now stands, the Corporation have not the copper for sale which cost them half the current price. But, on the other hand, year by year, the working plant is depreciating, and will have to be replaced—much of it probably long before the thirty years expire in which the Corporation set themselves to pay off their debt. All present neglect of electricity concerns will be to the future advantage of the gas industry.

In connection with this question of depreciation, the "Electrical Times" has fastened on to a little discrepancy between precept and practice, which affects the Newcastle-upon-Tyne Electric Supply Company, Limited, and Mr. C. H. Merz, the Consulting Engineer of the Company, and projector of the Administrative County of London and District Electricity Power Company's scheme. The accounts of the Newcastle Company indicate that the depreciation contribution only amounts to a fraction over 1 per cent. of the capital expenditure. In the Committee rooms at Westminster, Mr. Merz has strongly insisted on the necessity of providing 5 per cent. depreciation as the minimum for generating plant, or 3⅓ per cent. on the gross capital. Dr. Merz (father of Mr. C. H. Merz) is the Chairman of the Newcastle Company; and for the expressed reason that no one really knows what depreciation should be allowed, he opposes the taking of the most prudent course. But perhaps the expressed reason is not the real one. Our electrical contemporary points out that if the depreciation rule advocated by the son was adhered to, the Company would only be able to pay about 1 per cent. on the ordinary shares. So there is more in Dr. Merz's views than meets the eye. Conditions control acts.

With all the screwing up there has been in the Westminster City Council to get a vote favourable to the Westminster Electric Supply Corporation and flame arc lamps for lighting Whitehall, the Council, by 19 votes to 18, have decided to accept the tender of the Gaslight and Coke Company. The figures from the respective tenders were commented upon in the "Memoranda" for June 12 last; and they should be looked up again in conjunction with our report of the debate that took place on the subject last Thursday. Such a thoroughfare as Whitehall ought not to be made the scene of the experimental work on public lighting of the Westminster Electric Supply Corporation, as they proposed, for eighteen months, during which time nothing was to be charged the ratepayers for the lighting, though the Supply Corporation, according to their figures, intended looking to it that in the end they suffered no loss. The Works Committee of the City Council first recommended acceptance of the Gaslight and Coke Company's tender. Then a sufficient number of members in the Council was found to get the report referred back. The Committee then brought the matter up again; but they had trespassed on the prerogative of the ladies, and had changed their minds, considering it advisable, under all the circumstances, that the lowest tender of the Electricity Corporation should be adopted. This street lighting question is a business matter, and not one to be wafted first one way and then the other to please a few interested or prejudiced councillors. Though the Committee had changed their minds, their original proposal was adopted, by a majority of one, which was sufficient for the purpose. Passing from Westminster to Camberwell. The latter borough is at the present time one of the most economically lighted in London. Notwithstanding, and in spite of the rates amounting to 9s. 4d. in the pound, and the debt to £600,000, the Council are proposing to apply for an Electric Lighting Order. "Sufficient unto the day is the evil thereof"—financial or otherwise—is the opinion of the ratepayers. They have consequently held two large meetings, and have passed resolutions protesting against the Council increasing their liabilities. Deputations have been sent to the Council; and irate ratepayers have shown in no unmistakeable manner that the Council are not going to be allowed to do as they please in this matter. The ratepayers have not even been appeased by a promise that not a penny shall be spent on an application for an Order until the matter has been fully discussed by the Council in September.

Crossing the Thames again to the City, and still on this public lighting question, the annual report of the City Engineer (which is noticed in our news columns) will inform our electrical friends that 599 additional incandescent gas-burners have been fixed during the past year—making a total of 2839. The number of electric lamps in the City is only 465; and pretty steep prices the citizens are paying for them! Going northward to St. Pancras, a return just issued shows that in 1895, the total expense of lighting the district was only just about what is now being paid for the partial lighting of the streets by electricity. In the twelve months ending Lady-day, 1895, £8839 was paid for gas, the average number of lamps being 4312, and the price of gas 2s. 2d. and 2s. 3d. per 1000 cubic feet. During the same period, £4426 was paid for electricity at 6d. and 5d. per unit; energy being supplied to 96 lamps. For the year ended Lady-day, 1906, the amount paid for gas was £3734, the number of lamps being 2024, and the price of gas 2s. 2d. per 1000 cubic feet. During the same period, the amount paid for electricity was £13,376, the number of lamps being 831, and the price 1½d. per unit. This is the result of municipal ownership of an electric lighting concern.

From the North came the promoters of the Administrative County of London and District Electric Power Company; and to the North they have returned. The scheme for London having been "held up" by such a powerful trio as the House of Commons

the Board of Trade, and the London County Council, has given to the Chairman of the Administrative Company (Mr. James Falconer) and the Engineer (Mr. C. H. Merz) leisure in which to look out for new fields to conquer. Their eyes have alighted on the territories of the Cleveland and Durham County Electric Power Company and the Northern Counties Electricity Supply Company; and arrangements for the purchase of the shares of these concerns having been made, a Company has been floated under the title of "Cleveland and Durham Electric Power, Limited," with a capital of a million sterling. The Durham Company have expended more than £300,000 upon their undertaking. They have, however, only commenced business at two small pioneer stations at Consett and Bishop Auckland, but their main power station at Grangetown is now nearly finished. The Northern Counties Company have spent about £350,000, and are supplying for power and lighting in Alnwick, Ashington, Bedlingtonshire, Blyth, Cowpen, Felling, Hartlepool, Hebburn, Malton, Morpeth, Norton, Sheldon, Spennymoor, and Thirsk. We have said before, and it may be said again, the appearances are that we are in the penultimate state of electricity supply in this country, and that the ultimate state will be attained by the gradual dropping into the hands of these huge concerns of the separate electricity undertakings that exist in their districts, except perhaps in the larger cities and towns. When Mr. Merz and his colleagues take up a fresh scheme, there is something magical in their touch, or it is assumed that there is. In their hands, the prospects of this new venture are simply wonderful. By long and rapid strides, the profits are going to more than double, according to the estimates, in two years—from £24,360 in 1907 to £52,800 in 1909. Upon this, it goes without saying that the promoters are exceedingly sanguine as to the valuable character of the district they propose to exploit, with its iron mines, industrial areas, and coalfields, all hungering for electrical power. During the first year in fact, the combined undertakings will, it is expected, have an output of 19 million units; and, if all the factories in the district were electrically driven, they would require 150 million units per annum! One advantage that the new Company possess is that the works' construction period has been saved. Fancy this gold mine coming in the nick of time to fill the gap caused by the ruin of the scheme that was to do so much for the amelioration of the conditions of the Metropolis and the surrounding counties!

But while in the North, Mr. Merz and his colleagues are promising marvellous things by investment in their schemes, that piece of frailty in the electrical power supply line, the South Wales Power Company, has at length satisfied itself that it is in a very bad way; and Mr. Merz, as a specialist, has been called in to advise and prescribe. It was only just recently that those concerned in the direction of the Company, to use the words of the Chairman (Mr. Robert Fleming) at a meeting of those interested in saving the undertaking if possible, came to the conclusion that the whole thing is in an "unfortunate" and "precarious" position. And so it is; and it will indeed be a big thing if it is ever pulled round to a healthy state. Nothing but most far-reaching measures will suffice. There has been a Money Bill in Parliament from the Company; but, on the experiences of the past, that Bill will not be of much avail, as people will not feel very trustful over a concern that has made such a bad start. The Bill gives the right to the Board to issue a further million of share capital, and £500,000 of prior lien stock; but who but fools and friends of the concern will be prepared to incur further risk? Mr. Merz advocates most drastic methods. The present installation, put down in comparatively small units, must be pulled out root and branch, and a more comprehensive scheme be adopted. Mr. Merz's view is that, if things are done on a large scale at the generating end, tremendous savings will be made—as an example, by a 15,000-horse power turbine, he says electricity can be generated at one-third the cost per horse power that would obtain with 500-horse power turbines. But the plant is not the only thing that has disappointed those involved in this South Wales blunder. They are also disappointed with the slowness with which connections have been made in the past. It is all very well to talk about low generating costs that are to be obtained by abandoning the present plant, and wasting a great part of the present capital expenditure; but if people will not do business with the Company on a scale sufficient to keep a large concentration of plant at work, what is the good of having such plant, and discarding that which now exists? To get the low costs that Mr. Merz talks about, the plant must have custom enough to keep it running at its maximum capacity. There is another thing besides generating costs that these Power Companies find necessary. It is that they must be in a position to offer assistance to prospective consumers on easy terms, in order to induce the making of changes of plant. When, as in the South Wales Company, ¾d. per unit is charged for current for power, and on the top of this comes the capital charges for new plant, the manufacturer or colliery owner looks well to see what he is going to gain over his present power methods. If Mr. Merz's plans are adopted in South Wales, the colliery owners will have to look closely into what his scheme of rent per horse power and a small charge per unit really mean in each individual case. Some of the colliery owners will find that for them it will come to much the same thing as a flat-rate per unit, with nothing to pay per horse power of plant installed. Meanwhile, it seems absurd to associate this South Wales weakling with "power." The experience in South Wales should cause Parliament to hesitate before committing the London ratepayers to any County Council scheme.

NOTES FROM WESTMINSTER.

At this period of the session, when most of the Bills in which our readers are interested have either received the Royal Assent or are awaiting it, the business at Westminster is not of such a nature as to be fruitful of subjects for notes; yet in the course of the past week a few matters arose to which attention may be directed.

Gas Orders—The New Testing Clause.

In the first place, the Unopposed Bills Committee, under Mr. Cardwell, had before them on Friday the three Bills introduced by the Board of Trade to confirm Gas and Water Orders for which application had been made to them. These Bills had all come down from the Lords, and the only amendment of importance made in them was the insertion of the Model Clause relating to the testing of gas; thus bringing the Orders and Bills into line on this matter.

Rival Water Companies in Kent.

The progress of the Water Orders Confirmation Bill was not quite so smooth as that of the Bills just mentioned. It contained an Order applied for by the Mid-Kent Water Company, who wish to extend their limits of supply so as to include Biddenden, High Halden, and Frittenden, and raise £40,000 of additional capital. No opposition was made to these proposals when the Bill was in the Upper House; but now the Cranbrook Water Company entered a protest against the promoters coming into districts which they claimed as their own. The position of the parties was rather a peculiar one; and the Order had given the officials of the Board of Trade some trouble. But, as will be seen from our "Parliamentary Intelligence," they were so convinced that the promoters were justified in applying for the Order, that they dispensed with the consents of certain authorities which are usually necessary in such cases. At the same time, they recognized that the Cranbrook Company had statutory rights over the area in question; and, although they made the Order, they left it open to the Company to oppose its confirmation, and threw upon the Select Committee to whom the Bill was referred the responsibility of dealing with it upon its merits. Although in possession of the right to supply the three places named, the Cranbrook Company had been very tardy in exercising it; and therefore the promoters thought they might as well endeavour to obtain an extension of their limits and their business. This decision evidently roused the Cranbrook Company to action; for they promptly put down some mains. Mr. Wedderburn, on their behalf, assured the Committee that there had been no neglect of duty on the part of the Company; they had simply waited for a demand for water. They were already supplying Biddenden, and meant to be in High Halden in six months; but he acknowledged that he could not give any pledge in regard to Frittenden. Mr. Knox, for the promoters, stated that if the Committee would grant the powers sought, the Mid-Kent Company would undertake to supply the three parishes named in twelve months' time. Mr. Wedderburn submitted that there was no precedent for granting an Order giving powers of supply to an outside Company where these were already in the hands of an existing one. The Committee, however, thought the circumstances of the case justified them in establishing a precedent; and they confirmed the Order. Mr. Wedderburn made a final stand for the Cranbrook Company, and asked the Committee to say that the Mid-Kent Company should not come into their district if within six months his clients were supplying water in any one of the three parishes. But the Chairman declined to add any such stipulation to the Committee's decision. The promoters accordingly get the powers they sought, untrammelled by conditions.

Sutton Water Company Victorious.

In the "Journal" for the 10th inst., we indicated the purpose of the Bill promoted by the Sutton District Water Company. It may be remembered that it was to prevent the London, Brighton, and South Coast Railway Company from using anywhere over their system the water obtained from a well they are sinking in close proximity to the sources of supply of the promoters. The latter very naturally objected to any such wide distribution of water drawn from the area on which they depend for maintaining their service; and we characterized as public-spirited their action in promoting the Bill. This view was shared by the various Local Authorities in the district; for we do not recollect any case in which a Water Company's Bill had so many petitions presented in its favour by public bodies. Indeed, the only opponents were the parties whose action necessitated its promotion—the Railway Company. Moreover, it was a "late" Bill. Yet the officials of the House thought it was of sufficient importance to justify the suspension of the Standing Orders to allow it to proceed. When it came before the House of Commons Committee, they were so satisfied with the justness of the promoters' case, that they did not require the objections of the opponents to be answered, and passed the preamble. The Bill came before a Committee of the Upper House on Thursday, when it received the same general support from the Local Authorities, and once more encountered the sole opposition of the Railway Company. Mr. Freeman, on their behalf, tried to convince the Committee that what the promoters were asking was absolutely unprecedented in parliamentary

history, and that the Railway Company had a perfect right to use the water from their well for any legitimate purpose they pleased. He assured the Committee that they did not desire to injure anybody's supply, and would only use a reasonable quantity of water outside the area of the Water Company. He expressed his willingness to limit the quantity of water taken to 500,000 gallons—an offer which caused some laughter, and was politely declined. He thought the matter was one for arbitration. Mr. Fitzgerald, however, for the promoters, pointed out that any arbitration would have to include the question of the effect of the well upon the neighbouring springs. In the result, the Committee passed the Bill.

Yarmouth and Lowestoft Bill Rejected. Everybody who has followed the progress of Bills in Parliament is aware that the passing of a measure in one House is no guarantee that it will be equally successful in the other. In the Commons, as a general rule, broad and businesslike views are brought to bear in the consideration of Bills promoted in the public interest; and, as the result, they go up to the Lords—possibly with certain reasonable amendments—to undergo their scrutiny. In the serener atmosphere of the Upper House, they come within the purview of men of a different order of mind, who sometimes fail to see eye to eye with their predecessors, and put the *quietus* upon their labours by deciding that "it is not expedient to proceed further" with the measures they have approved—which may be regarded as a euphemistic periphrasis for the sententious "preamble not proved" of the Lower House. In other cases, the order is reversed—the Commons rejecting what the Lords have sanctioned. An instance of this was afforded last week, when a Select Committee presided over by Mr. Toulmin declined to support the Lords' decision on the Great Yarmouth and Lowestoft Water and Gas Bill. This measure, it may be remembered, was promoted by the Great Yarmouth Water Company and the Lowestoft Water and Gas Company to obtain authority for the construction of additional water-works and for taking water from the River Bure, to enable them to afford increased supplies in the two towns named; but it was opposed by the Yarmouth Corporation, mainly on the question of the proposed source. The Lords, however, passed it, on the understanding that certain conditions contained in the reports made by the Home Office and the Local Government Board respectively were complied with; and when it came before the Committee of the Lower House, Mr. Balfour Browne, for the promoters, said this had been done. The Corporation suggested an alternative scheme, by which an additional supply of water could, it was stated, be obtained from a place called Brundall. But Mr. Balfour Browne said he should be prepared to show the Committee that the possibility of getting water there was purely speculative. As before, the evidence turned mainly upon the suitability of the Bure as a source of supply; and while eminent witnesses supported the promoters' scheme, others equally distinguished were opposed to it. Who shall decide when doctors disagree? The Committee had the Bill under consideration for six days, and eventually yielded to the appeal made to them on behalf of the Corporation to reject it, unless they were satisfied that water could not be found from any other source than the river. Their decision was a proof that they were not satisfied on the point. The two towns will therefore have to be contented—for the present, at all events—with the existing supply.

Control of Gathering Grounds. One other matter reported in our "Parliamentary Intelligence" to-day may be briefly referred to. Mr. Donald Maclean, the Member for Bath, put to the President of the Local Government Board a question on the subject of placing gathering-grounds under the control of a central authority, after due consideration by a specially constituted Committee. Mr. Burns replied that he was giving attention to the recommendation of the Sewage Disposal Commissioners on this matter; and he thought that any body to whom the subject alluded to might be referred could usefully deal also with the question of afforestation.

Public Lighting of the City of London.

The Annual Report of the Engineer to the Corporation of London (Mr. Frank Sumner, M.Inst.C.E.), which has just been issued, furnishes some interesting particulars in regard to the public lighting of the City during the twelve months covered by it—viz., to Dec. 31, 1905. In this period there were 599 additional incandescent lamps fixed. It may be remembered that the South Metropolitan Gas Company lent the Corporation a "Carpenter" incandescent lamp as an experiment; and it gave so much satisfaction that the Streets Committee accepted a tender for fixing about 500 of them. The number of gas-lamps paid for by the Corporation at the end of the year was 2839; being an increase of 336. The incandescent gas lighting in the side streets has been practically completed. Particulars are given of the extensive adoption of gas in place of the electric light; and further details are promised in the next annual report. The number of defective lamps reported by the Inspector of Gas Lighting was 1358; the number observed by the police being 13. At the end of the year there were 465 electric arc lamps in use—being a reduction of 40; and 231 defective ones were reported by the police.

THE PERKIN COAL TAR COLOUR JUBILEE.

THE Deputies of Science and Industry last week celebrated the jubilee of the foundation laid to the great coal tar colour industry by the discovery of Perkin fifty years ago; and what is more Sir William H. Perkin was present throughout the celebrations, and personally received the tributes of the learned and industrial societies of the world which have in any way a relationship with his grand original work. Coal tar may not—comparatively with that long time ago when the youth Perkin penetrated its previously latent riches—have shown any positive gain in the matter of price. But some half-century ago the conditions were vastly different from what they are to-day. The carbonization of coal has increased by leaps and bounds—not only for the production of gas, but for the production of the working requirements (such as coke) of other industries; and it is fitting to ask what would have been the position of coal tar to-day, with its ever-increasing volume of output, if Perkin had not made the primary discovery that has resulted in the development of remarkable industries? It must be agreed that industrially Germany has benefited more than this country from Perkin's great discovery; but it must not be forgotten that, while Perkin laid the foundation, while he directed the way, the union of Science and Industry in Germany has done more in the development of the coal tar colour industry than it has done in any other country. During the celebrations last week, Germany was lavish—not too lavish—in its homage to the man and his eminent work. That work has benefited nations. Upon it new industries have risen and flourished, and it has introduced new beauty into the world's every-day life. And the base of it all is coal tar. If to the full his native country has not derived the benefit of the discovery of fifty years since, the fault is not that of Perkin. But he is of our country. Our country has—late in his days, it may be—honoured him; and, in the first place, by the knighthood conferred but recently by the King. While, let it be said at once, the discovery of mauve rapidly enriched him, Sir William's life has been devoted to that Science which yielded up to him so early in his career one of her great secrets.

The story of the discovery of mauve is almost romantic as it was heard from Sir William's own lips in the Lecture Hall of the Royal Institution last Thursday, which lecture-hall he first visited 54 years previously. At that day he was a schoolboy of fourteen. His old schoolmaster, Mr. Thomas Hall, of the City of London School, who was greatly interested in Perkin owing to his liking for science, induced him to write to Michael Faraday, who was then about to give a series of lectures on electricity in that very theatre, telling him how much he (Perkin) would like to attend those lectures. Faraday sent him an order, written by his own hand, to admit him to the course. Let Sir William tell the remainder of the story in his own words: I little thought then that in four years' time (at the age of eighteen) I should be the fortunate discover of the mauve dye, a product which in an indirect way is related to Faraday's scientific work, for it was in 1825 that Faraday discovered benzene, which has been the initial product for the production of aniline from the commencement of the coal tar colour industry, and, of course, for mauve. This fact directly connects the industry with the Royal Institution, because it was in this building that Faraday by his researches discovered benzene. [The original specimen discovered by Faraday in 1825 was on the table before Sir William while he was speaking.] And further I little thought that in a few years' time—May, 1866—Faraday himself would attend a meeting of the Chemical Society, as he did, to hear me give a lecture on "Colouring Matter Derived from Coal Tar," and then encouraged me by his remarks. These were all things that naturally never entered the mind as I, a boy, sat in this lecture-hall. How much less could I have dreamed that fifty years after I had obtained the mauve, I should be here at a golden jubillee celebration of the discovery of that dye. And, moreover, who could have formed any idea of the wonderful development of the coal tar colour industry that exists to-day, started from such small beginnings, but which, through the researches of an army of scientific men, is now of such colossal magnitude . . . I cannot take all the honour to myself for what happened in those early days after the discovery of mauve. There are others who deserve much of it, but who are no longer with us. I refer to my late father and brother. They joined me when this industry was first started; the firm being known as Perkin and Sons. My father, who was a builder, was much disappointed when I took to chemistry, as he wished me to be an architect. Nevertheless when I obtained the mauve he risked most of the capital he had accumulated by a life of industry, in building and starting the works at Greenford Green, evidently having great confidence in me. This was indeed a very noble act on his part, for which I have always felt very grateful; for had it not been for this, I probably should not have been able to start this industry, as few would have been inclined to take the risks connected with the manufacture of such a new and untried product as the mauve dye then was. My father only lived for about nine years afterwards, but fortunately was rewarded by seeing the undertaking a success. My brother, Mr. T. D. Perkin, who was expected to follow my father's business, helped me in my first small manufacturing operations before the works were commenced. He afterwards conducted the commercial part of the undertaking with great

assiduity, and also took a practical part in the works with great success; and we worked harmoniously together for seventeen years, until the works were sold in 1873. Therefore it will be seen to what a great extent the collaboration of my father and brother had to do with the early success of this industry; and consequently I feel that much of the honour lavishly given me to-day should be accorded to them.

The celebration of the coal tar jubilee of last week was an international one; and it was the outcome of a public meeting held at the Mansion House in February of last year. The arrangements were conducted for the British Committee under the auspices of the Chemical Society, to which Sir William Perkin has been attached all his working life; the Chairman of the Committee being Professor R. Meldola, and the Secretary, Professor Arthur G. Green, of the Leeds University. The celebration opened at the Royal Institution on Thursday morning, when the speech was delivered from which the above story is taken. On this occasion there were presented to Sir William his portrait in oils, painted by Mr. A. S. Cope, A.R.A. (which it is provided is to pass eventually into the custody of the Nation), and a replica of a marble bust for the rooms of the Chemical Society, executed by Mr. F. W. Pomeroy, A.R.A. The Hofmann medal from Germany, and medals and addresses from other countries were also showered upon Sir William, who, throughout the severe ordeal, maintained a strikingly calm demeanour, and gave most courteous acknowledgment to the many congratulatory addresses, copious and sincere, that fell upon his ears from all countries, and in several languages. Sir William's is a fine personality. Despite his age—close upon seventy—despite the severe discipline demanded by a life of research and the exercise of the great talents with which he is endowed, there is nothing of the ascetic about him. Manliness in form and movement are still his; and his speeches disclosed the store of mental power. That was the central figure—in the historic hall and home of science in Albemarle Street on Thursday morning—of a distinguished company of both ladies and gentlemen. A rapid glance sufficed to show the delicate compliment conveyed by the predominance of mauve in the decoration of the ladies' dresses. Professor Meldola was in the chair; and, looking round, many bearers of names of renown in science and the arts were to be found scattered in the packed audience, including Lord Kelvin, Sir James Dewar, Sir H. Roscoe, Sir William Ramsay, Sir T. Stevenson, Sir B. Redwood, Professors Armstrong, Smithells, Frankland, and Clowes. Among the representatives of the technical societies were Mr. James W. Helps and Dr. Harold G. Colman.

What need be said of the proceedings? Readers will readily divine their nature. From the opening address of Professor Meldola (in which he made the presentations of portrait and replica of the bust referred to above), there was a continual flow of eloquent congratulation and panegyric on the achievements of Sir William Perkin. Dr. Emil Fischer, one of Germany's greatest chemists, presented the coveted Hofmann medal from the Deutsche Chemische Gesellschaft; and Sir William prizes much this particular distinction, seeing that it was established in memory of Dr. Hofmann, under whom he studied chemistry, and whose assistant for a period he was. The enthusiasm and force of character of the great master, Sir William owns, stimulated his own natural desire for research, and helped to establish him in a course which he has pursued for some fifty years. The Lavoisier medal was presented by Professor A. Haller, on behalf of the Société Chimique de Paris. In acknowledging this, Sir William stated how, when mauve was first introduced, the silk dyers took to it readily; but the cotton dyers and calico printers in this country did not seem at all keen about it. The French, however, immediately applied it to calico printing, with the result that, when their productions came on to the market, calico printers in England had quickly to follow suit. From scientific societies of America, Austria, Holland, and Switzerland, tributes of respect and messages of congratulation followed; and then numerous addresses succeeded from the industries built upon the discovery of coal-tar colours. Following these were addresses from the Royal Society, the Chemical Society, the Society of Chemical Industry, the Institute of Chemistry, and the Society of Dyers and Colourists. Professor Smithells was the bearer of one from the University of Leeds, and Mr. James W. Helps from the Institution of Gas Engineers. This was as follows:—

To WILLIAM HENRY PERKIN, LL.D., Ph.D., D.Sc., F.R.S.

The President, Council, and Members of the Institution of Gas Engineers desire to join in offering to you their hearty congratulations on this the occasion of the celebration of the 50th Anniversary of your discovery of the first coal-tar colouring matter, "Mauvein," a discovery which has exerted a marked influence on chemical manufactures generally, and is of especial interest to all associated with the gas industry.

They recall with pleasure the fact that the Institution has already expressed its indebtedness to yourself by enrolling your name on the list of those to whom its Birmingham Medal has been awarded for originality in connection with the manufacture and application of gas, interpreted in its widest possible sense.

They trust that many years of health are still before you to enable you to continue the work of scientific investigation to which your life has been so usefully devoted.

Sealed by order of the Council of the Institution of Gas Engineers.

CHAS. HUNT, *President.*
J. W. HELPS, *Hon. Secretary.*
WALTER T. DUNN, *Secretary.*

July 23rd, 1906.

In handing the address to Sir William, Mr. Helps said: On behalf of the Institution of Gas Engineers, representing the gas industry of this country, I ask your acceptance of this address, and express the hope contained in the last paragraph that you may have many years before you in which to continue the work of research and investigation to which so many years of your life have been devoted. There was a shake of the hands, and words of thanks from Sir William.

The references here do not exhaust the list of addresses. To each Sir William made individual reply; and at their close, rapt attention was given to him while he made, in clear voice, one general reply. From that reply has been taken the story of the revelation of mauve, as reproduced earlier in this notice. And as the story was heard of the boy of fourteen listening to Faraday in that theatre 54 years ago, in the speaker it was realized that a remarkable chapter of the history of chemical science was concentrated. The world-wide ramifications of that discovery—chemical, industrial, utilitarian, beautifying, and its effect on capital and labour—are almost infinite. The great manifestation of the kindness and friendly feeling from far and near, brought forth these closing remarks from Sir William: "This is very gratifying to me at this period of life, when the sun is declining in the West, and the evening is approaching. At the same time, when I look back on my life, and consider all the way I have been led, above all I thank God to whom I owe everything, for all His goodness to me, and ascribe to Him all the praise and honour." There were ringing cheers; and the scene, pervaded by historic interest, dissolved.

In the evening there was a dinner at the Hôtel Métropole, at which again there was a great and distinguished gathering. Only one remark will be picked from the speech made by Sir William on this occasion. He stated that, since his own success, the discovery of new colouring matters has been most remarkable; and in the published list there are now 700 enumerated, all obtained from coal tar products. On Friday, there was a garden party, on the invitation of Sir William and Lady Perkin, at their house, "The Chestnuts," Sudbury; but this was preceded by a visit to the original aniline colour works at Greenford Green, where the first coal tar dye-stuff was manufactured in 1857. The final function was a soirée at the Leathersellers' Hall, in the evening.

It should be mentioned that the funds remaining, after defraying the cost of the portrait and bust, are to be devoted to the endowment of chemical research in the name of Sir William Perkin, the fund to be administered by the Chemical Society, of which Sir William was at one time the Hon. Secretary and later President, and the transactions of which have been greatly enriched by his contributions.

ASSOCIATION OF ENGINEERS-IN-CHARGE.

Visit to the Engineering Department of the Houses of Parliament.

By the courtesy of Mr. E. G. Rivers, Chief Engineer of H.M. Office of Works, between sixty and seventy members of the Association of Engineers-in-Charge were last Saturday enabled to inspect many of the principal features of the engineering department of the Houses of Parliament. The party were received by Mr. A. P. Patey, the Resident Engineer, and Mr. W. H. Bowden, his Assistant.

The plant is an extensive one, and includes a battery of boilers for supplying the large amount of hot water required, and also the steam for motive and heating purposes. The "atmospheric" system of heating is employed, working at a pressure of 6 oz., with fans in connection capable of delivering 40,000 cubic feet of air per minute. The air, previous to its entering the House, is passed through a wool screen 6 inches thick, and having an area of 1000 superficial feet. The huge coke fire (on such a warm day) at the base of the Clock Tower emphasized its importance as an extracting agent in connection with the ventilating arrangements. The method of lighting the House from the centre by means of 64 argand burners, placed behind screens, for the purpose of modulation, and also the advantage taken of the heat generated at this point for extracting the vitiated air, are very interesting. There are three Shone's ejectors capable of dealing easily with a drainage system covering nearly 10 acres. The total lift from the ejectors to the main sewer is 11 ft. 3 in. Owing to insufficient accommodation under the House, the Westminster Electric Supply Company maintain a separate plant for generating the current for lighting and power.

At the conclusion of the visit, Mr. Davey, Chairman of the Association, proposed a very hearty vote of thanks to Mr. Patey and Mr. Bowden, which was seconded by the Hon. Secretary, Mr. H. Capsey. Mr. Patey briefly acknowledged the compliment.

Many of our readers will, we are sure, learn with regret that Mr. Maurice Graham was taken seriously ill about a fortnight ago, and that a surgical operation was found to be necessary. This was successfully performed last Wednesday; and we are pleased to find that, according to the latest accounts, he is making satisfactory progress.

GASLIGHT AND COKE COMPANY'S REPORT.

The following is the report on the working of the Company during the six months ending the 30th of June, which with the accounts [see p. 329] will be submitted to the proprietors on Friday. It is the first report issued bearing the signature of Mr. Corbet Woodall as Governor.

The accounts for the past half year show that, after providing for fixed charges, and setting aside £10,000 for the half year towards the redemption fund, in accordance with the provisions of the Company's Act of 1903, there remains a balance of £363,650 19s. 10d. The amount brought forward from the previous half year being £181,298 12s. 4d., there is a total sum available for distribution of £544,949 12s. 2d., out of which the Directors recommend a dividend on the ordinary stock at the rate of £4 8s. per cent. per annum, which will absorb £334,468, and leave the sum of £210,481 to be carried forward to the credit of the current half year.

The sales of gas for the half year show an increase of 3·94 per cent. over those of the corresponding half year of 1905. There has during the past six months been an addition to the number of consumers of 13,412, and an increase in the number of gas-stoves sold and let out on hire of 14,379. The market for residual products has been steady, and prices generally have been maintained.

The Directors have to report that the annual contracts for the supply of coal have been made at prices materially higher than those of last year.

The Hybrid Committee of the House of Commons appointed to consider the London County Council (Electric Supply) Bill decided, after prolonged investigation, not to pass the preamble. The Company opposed the Bill with a view to obtaining protection both as ratepayers and as trade competitors. Protective clauses in sundry other Bills affecting the Company's interests have been obtained.

The Directors have to announce, with deep regret, the death of Colonel Sir William Thomas Makins, Bart., who served as a Director of the late Western Gaslight Company and of the Gaslight and Coke Company for forty years, during the last twenty-three years of this period as Governor of the Gaslight and Coke Company. Sir William Makins' services were many and various; and his loss is greatly lamented by the Board. The vacancy created by his death has been filled by the election of Mr. James Douglas Walker, K.C.

It is also with great regret that the Directors have to announce that Mr. John William Field, whose connection with the Company extends over a period of fifty years, has, owing to ill-health, felt compelled to resign his seat at the Court. He occupied for many years the position of Accountant, and subsequently that of Secretary and General Manager of the Company, and in 1903 was elected a Director. By his retirement, the Directors have lost the assistance of one whose great knowledge of all matters relating to the gas industry rendered him a most valuable colleague. The vacancy thus caused has been filled by the election of Mr. Herbert Jameson Waterlow.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distribution Departments respectively with the usual certificates that all the Company's plant has been maintained in thorough efficiency.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly Report.

The following is the report of the Directors of this Company for the six months ending June 30, which, with the accounts for this period (some particulars from which are given on pp. 329-30.) will be presented to the proprietors at the half-yearly meeting to be held to-morrow week.

The price of gas was reduced to 2s. per 1000 cubic feet from Midsummer, 1904. From that time also the price of coke fell considerably. Consequently, although the consumers have benefited to the extent of £50,000 a year by the last penny reduction in price, the profits have not been sufficient to permit the payment of the dividend to which the shareholders are entitled under the sliding-scale. With a 2s. price, the authorized dividend is £5 14s. 8d. per cent.; and had it been earned, £5 13s. 4d. would have been divided. But seeing that the respective deficiencies in the three half years were at December, 1904, £28,372, at June, 1905, £7410, and at December, 1905, £16,616, or £52,398 in all, which has nearly absorbed the whole of the balance brought forward at June, 1904, the Directors did not feel justified in recommending the higher dividend, which would have necessitated withdrawing a considerable amount from the reserve fund.

The Directors have the pleasure to report that, after charging everything to revenue that can be legitimately charged, and materially reducing the monazite sand suspense account, they recommend that a dividend at the rate of 5½ per cent. per annum be declared, adding the surplus of £266 18s. 2d. to the balance, which will then amount to £5950 2s. 1d., to be carried forward to the following half year.

The saving of gas resulting from the use of incandescent mantles still keeps down the rate of increase. With this factor in view, the increase of nearly 3 per cent. over the corresponding half year is satisfactory.

With the improvement in the iron trade, the price of coal has advanced somewhat. In 1872, in 1890, and in 1900, there were somewhat similar advances, followed in the succeeding years by further enormous increases. Gas companies feared that they would not be able to get coal, and allowed the coalowners to more than double their prices. On no occasion has there been any scarcity of coal; and it is to be hoped that never again will the buyers of gas coal submit to any such extravagant demands. Putting coal and freight together, the extra cost to this Company for twelve months' supply will probably amount to £60,000.

The receipts for tar and ammonia are a little lower. The former—notwithstanding all the very valuable products derived from tar—has realized very little over 1d. per gallon, which is about its value for fuel. It would be well for gas undertakings to cultivate a demand for other purposes than distilling, and to sell as much tar as possible for fuel and for road-making at contract prices everywhere. By thus taking tar out of the market, its value for distilling to obtain the many extraordinarily useful products will be enhanced. At present gas makers derive no benefit whatever from all the wonderful coal-tar discoveries of which so much is now being said—due solely to over-production. Tar should be worth 6d. a gallon for distilling, if the quantity offered to the market were no more than its needs.

Reference has been made to monazite sand, from which the constituents of incandescent mantles (thorium 99 per cent. and cerium 1 per cent.) are obtained. The convention controlling the price of thorium has this year reduced the price by about one-half. The result is that certainly for a time mantles will be plentiful and cheap. With thorium at this price, the object of the Company in purchasing the monazite property in North Carolina has been attained—viz., relief from all fear of interruption in the supply of good mantles at a reasonable price. It is not at present necessary to work that property to any great extent, but it may be reserved for future contingencies. So far as the Company are concerned, the supply of mantles is assured for many years.

The amount credited to the employees of all ranks under the co-partnership system for the last twelve months is the large sum of £43,961 19s. 7d., being at the rate of 9¾ per cent. on salaries and wages. Attention is drawn to this item for two reasons: The Directors in the first place feel it ought to be brought prominently to the notice of the shareholders, because it is in addition to standard salaries and wages, and can only be justified on the ground of business, and not philanthropy. Secondly, the employees are reminded that unless the payment of this large annual sum can be justified as good business, it will be the duty of the Board to give notice to terminate the co-partnership scheme. Its continuance, therefore, rests entirely with the employees. Happily, the Directors are able to state that the results have surpassed their most sanguine expectations. The employees generally of all ranks (there are still some few indifferent men) manifest great interest in the welfare of the Company, in which over £320,000 of their savings is invested; and the Directors are glad to know that, by thus saving their annual bonuses, their condition in life and their prospects have been greatly improved.

Irish Association of Gas Managers.

The annual meeting of this Association will be held in the City Hall, Dublin, on Tuesday, the 14th prox., under the presidency of Mr. R. Bruce Anderson, Assoc.M.Inst.C.E., of Westminster. We learn from the programme issued by the Hon. Secretary (Mr. James Whimster, of Armagh) that the proceedings will be opened by the Right Hon. the Lord Mayor, and that the principal business will consist of the President's Address and three papers. Mr. James Brodie, of Omagh, will contribute "Some Notes on a Gas-Works Transfer Arbitration;" Mr. J. F. Davis, of Manchester, will direct the members' attention to "Some Commercial Uses of Gas," comparing the position of things ten years ago and now; and Mr. S. J. B. Tully, of Kinsale, will describe "Simple Methods of Gas Analysis," with illustrative experiments. A resolution will be submitted by Mr. J. G. Tooms, of Waterford, to authorize the election of new members and office-bearers by ballot. The social portion of the programme is specially attractive. On Tuesday evening, the members and their ladies are invited to dine with the President and Mrs. R. Bruce Anderson at the Dolphin Hotel; and on Wednesday there will be an excursion to Glendalough, with its "gloomy wave," Seven Churches, and Round Tower. The route will be from Rathmew, *viâ* the Devil's Glen on the outward journey, and *viâ* the Vale of Clara to Rathdrum on the return. Luncheon will be served at Glendalough, amid some of the finest and most romantic scenery in the Sister Isle.

In referring to the late Mr. J. Alfred Wanklyn last week, it should have been mentioned that he was the author of "The Gas Engineer's Chemical Manual," which was published about twenty years ago.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Edinburgh.

The Forty-Fifth Annual General Meeting of the North British Association of Gas Managers was held in the Freemasons' Hall, George Street, Edinburgh, last Thursday. Mr. W. B. M'Lusky, the Gas Engineer and Manager to the Corporation of Perth (the President) occupied the chair; and there was a very large attendance of members.

The President, in opening the proceedings, said he thought they might take it that the meeting in Edinburgh was to be as successful as its predecessors. He was sure the fare to be provided was sufficient to attract a large attendance.

Friendly Greetings and Apologies.

The members would be very pleased to learn that they had a number of friendly messages from their brethren in the South—from Mr. Charles Wood, the ex-President of the Institution of Gas Engineers; Mr. Fletcher W. Stevenson, the President of the Midland Association; Mr. J. H. Brearley, the President of the Manchester District Institution of Gas Engineers; Mr. Thomas Canning, the President of the Wales and Monmouthshire Institution of Gas Engineers; Mr. R. G. Shadbolt, the President of the Eastern Counties Gas Managers' Association; and Mr. E. G. Sutcliffe, the President of the Yorkshire Junior Gas Association. There was also a letter from Mr. J. G. M'Geachin, the Manager of the Dumbarton Corporation Gas-Works, one of their new members, who expressed his regret that he could not be present; and from Mr. Thomas Wilson, of Coatbridge, who, on account of a meeting of his Board, would not be able to join them till next day. At a later stage the President intimated apologies for absence from Mr. F. W. Cross, the President of the Southern District Association of Gas Engineers and Managers; Mr. Matthew Leaf, ex-President of the North of England Gas Managers' Association; Mr. William M'Crae, of Falkirk, who was unable to be present on account of ill-health; and Mr. W. Ewing, of Greenock. They would all, the President said, agree that it was most gratifying to have these messages from their brethren in the South. They would remember that at one time it was believed that Scotland was a detached island, having no connection with England; and, having regard to the motion which came before them last year, with regard to affiliation, they might have expected that their brethren in the South would have left them in a position of splendid isolation. But, like good Englishmen, like true Britons, they were still endeavouring to maintain a united gas industry, as they—the predominant partner in the Union—had always joined them in maintaining a United Empire.

The Report of the Committee.

The report of the Committee was submitted by the Secretary, Mr. R. S. Carlow. In this it was stated that the Benevolent Fund had not been drawn upon at all during the year. No question of any great importance on any special subject, either in regard to the manufacture or distribution of gas, had been brought under the notice of the Committee for consideration. The Committee's duties, therefore, had, in this respect, been of a very light nature during the year. There were, however, two motions to be put before them for consideration by Mr. J. W. Carmichael, of Barrhead, and Mr. L. Hislop, of Uddingston. At one of the meetings of the Committee, a letter was read from Mr. Dunn, the Secretary of the Institution of Gas Engineers, regarding the state of the Benevolent Fund of the Institution, and asking the members of the Association to subscribe liberally to the funds. The Committee resolved to take no action in the matter.

The President remarked that he thought the report was very satisfactory. It was always gratifying to see an increase in the roll. They had not a great many gas-works in Scotland altogether; and an increase of six per annum might be regarded as very satisfactory.

Mr. J. Whyte (Seaham Harbour) moved the approval of the report.

Mr. J. D. Smith (Stirling) seconded; and it was unanimously agreed to.

The Roll of the Association.

The following were admitted to the Association.

Ordinary Members.—Bruce, Henry, Inverurie; Campbell, Matthew, Stewarton; Cowie, Robert W., Lockerbie; Goodlad, Robert, Clydebank; Hunter, David, Millport; M'Geachin, Joseph G., Dumbarton; M'Gilchrist, John, Gourock; M'Gill, Robert, Annan; Muir, Gavin, Stonehouse.

Extraordinary Member.—Grieve, W. G., Edinburgh.

Associate Members.—Braidwood, George, Dawsholm; M'Kay, Nathaniel S., Renfrew; Purves, George S., Greenock.

The membership of the Association now numbers 239—made up of 160 ordinary, 57 extraordinary, 16 associate, and 6 honorary members. The total is six more than the preceding year.

Proposed Change in the Name of the Association.

Mr. J. W. Carmichael (Barrhead) had very great pleasure in moving that the recommendation of the Committee be given effect to—"That they alter the name of the Association to that of 'The Scottish Institution of Gas Engineers.'" It would require very few words from him to convince them that such a change was desirable. The idea of altering the name suggested itself to his mind from the correspondence they had had in connection with the affiliation question. In this correspondence, they were designated a District Association—at least, they were to be looked upon as that; and their representative was to be a District Member, if they affiliated. At the end of his remarks in connection with the affiliation question the previous year, he said: "I may say, gentlemen, in closing, that I can see perfectly well where the Institution of Gas Engineers is to benefit, both in membership and otherwise; but I fail to see what benefit we are to derive." To back up this, he might say that they had received a letter from Mr. Dunn, the Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers, dated June 29, in the following terms:

> It was resolved at the annual general meeting of the contributors to this fund, held on the 20th inst., that a communication should be addressed to your Association asking you to kindly consider the suggestion to take some special steps with a view of increasing the list of subscribers to the fund.
>
> Last year, the ordinary receipts fell short of the necessary expenditure by £16, so that the fund is really in need of further help. Great good has already been accomplished by its means, and the Committee are anxious to maintain the value of the grants which they have hitherto been enabled to administer; but the number of applicants for assistance is increasing.
>
> May I, therefore, on behalf of the Committee, ask you to be so good as to lay the matter before your members, which it is trusted may result in a good list of additional subscribers being got together from the North British Association of Gas Managers.

He left them to judge whether he was correct in what he said twelve months ago. The time might come when they would see their way to affiliate; but very few of their members were prepared to do so last year, or to lower the colours of the Association by being called a District Association. The question might be asked, How was it that they were described as a District Association? Well, he did not know. They could only guess at it. May be in the South they did not understand the ways and the habits, or feelings, of Scotsmen; but they thought that the real reason was that the name "The North British Association" did not convey a very clear idea of what was meant—whether it applied to the whole of Scotland, or only to a part. Therefore it was their duty, as an Association, to clearly define their position; and if they took a new name, they would be able to say they were not a District Association, but a National Association. They had dropped the word "Managers," because the Committee looked upon the Manager as the man who engineered the works, whatever their size might be. He sympathized with those who might be connected with the pioneers of the Association. They might think a link with the past was being cut, and feel a little sore over the matter; but, while granting that this might be so, he would like them to understand that they were not breaking away from the aims and the objects of the Association, or from what the pioneers had in view. Let them go back to the year 1862, when the Association was started. Four gentlemen met in Cupar Fife—Mr. Lowden, of Leven, Mr. Myers, of Broughty Ferry, Mr. Proctor, of Forfar, and Mr. M'Kenzie, then of Cupar Fife. They had before them the question of whether they should form an Association or not; and they decided to do so. But they asked the co-operation of other Managers—more especially in the counties of Fife, Perth, and Forfar. They sent out letters to them; and at the next meeting held, they had twenty members. They drafted rules; and they agreed to call their Association the "Fife, Perth, Kinross, and Forfar Gas Managers' Association." Then, in 1864, it was intimated that two other Associations had started—the Scottish Gas Managers' Association and the British Association of Gas Managers. Some little time after this, a letter was received from Mr. Young, of Dalkeith, who was President of the Scottish Gas Managers' Association, desiring amalgamation with the Counties Association. The Committees met, and in 1866 the amalgamation took place. The funds were to go for mutual benefit, and the name of both was then changed to that of the North British Association of Gas Managers. So that they saw the pioneers themselves changed the name of the Association; and he could not see what harm it would do them to do so to-day. By the change he was hopeful that the bond of union would be strengthened; and he trusted they would go forward, hand in hand, in some matters and desires, such as the receiving and imparting of knowledge, mutual benefit, and friendly intercourse. This was really what the four gentleman who met in Cupar Fife in 1862 desired. He had, therefore, very much pleasure in moving that the name of the Association be changed to that of "The Scottish Institution of Gas Engineers."

The President said he had very great pleasure in seconding the motion, for reasons somewhat different from those brought forward by the Past-President—Mr. Carmichael. He believed that it would strengthen the Bond of Union. He had a great respect for the old name, because it was a patriotic one; and as Scotland was the northern part of the kingdom, and as the British

Association represented gas interests in the South, so the North British Association represented gas interests in the North. Now when they had an Institution of Gas Engineers in England, they could have no better name than the Scottish Institution of Gas Engineers in Scotland. They might take the word "Scottish" in this case as an adjective more than as a geographical term. Therefore they would be to the Institution what the Scottish Office was to the Home Office. They spoke of the Home Office and of the Scottish Office; they spoke of the Home Secretary and of the Scottish Secretary; and now, if they passed this motion, they would speak of *The* Institution and the Scottish Institution. This might reconcile them to affiliation, because they would then get rid of that odious term "District Association," which was never imputed to them by anybody, but which, he thought, they, in a hurry—as some of their ancestors hurried—ran away rather quickly from, and closed the door too soon, leaving behind some of the things they might have taken with them. But it was very gratifying to find that their brethren south of the Tweed had taken a broad view of their action in this matter; and he was quite sure that if they resolved to change the name of the Association to that of "The Scottish Institution of Gas Engineers," they would find that it would go a long way to strengthen the Bond of Union.

Mr. J. Napier Myers (Saltcoats) said the proposition appeared to him so wantonly bad that he did not know how to amend it. He would like to let it be known in the Association that the proposal was by no means unanimous. It seemed to him that it came with rather bad grace from his friend Mr. Carmichael, who last year deprecated any change because of his experience as a Free Churchman. They had had this question of affiliation and changing before them for three years. If time were any object, they might welcome the subject as an opportunity for speaking; but really it appeared to him so trivial a matter that it was not worth the time expended upon it. The onus for this, however, was upon those who made the proposal, and called upon members who wished to walk in the old ways to change. The name of the Association at the beginning was of small importance; but after having worn it for upwards of forty years, he thought some better reason should be given for changing it than "I cannot see what harm it could do to change it." This was not sufficient for him. The proposal to alter the designation "North British" into "Scottish" would be a narrowing of their borders. He did not think they ought to do this by any change of name. "Institute" was, perhaps, a newer one; but he thought "Association" described a congregation of men such as theirs—banded together as they were by their sociable qualities—rather better than "Institute." He did not think the reasons which had been put before them were sufficient for them to change their name; and he moved that the subject be deferred indefinitely.

Mr. T. Lighbody (Renfrew) asked if the Committee had considered the financial aspect of the question.

The President: Yes.

Mr. T. Lighbody (Renfrew): Would you be good enough to give us the legal ruling as to the funds? Do the rules allow the change of the name of the Association? Does it not come to be a question whether, before you can change the name of the Association, you require to dissolve it, and form another?

The President: There is no Charter.

Mr. Lighbody: Then there is no possibility of any member making a claim against us?

The President: These are questions which have been before the Committee. We have discussed all these matters. Mr. Carmichael, as the mover in the matter, has taken legal advice. It will be found in the first paragraph of the rules that we are not associated at all.

Mr. Lighbody: Are the Committee prepared to take the responsibility now?

The President: The Committee have taken the responsibility now. But these are questions which do not affect the issue. A few shillings will put us on a legal footing. We are not on any legal basis just now.

Mr. Lighbody said he had great pleasure in seconding Mr. Myers' motion that the name be not changed, from the very same standpoint. He did not think that any benefit was to be derived from the change. They had had an independent career of forty years. Of late there had been a great many changes in Associations connected with gas management. The British Association was changed; the Institute was changed; and now it was the Institution. They were told that the British Association represented English interests, and the North British Association the interests in the North. Why should it not continue to do so? He did not like to see a large influential Association, such as the Institution of Gas Engineers in London, writing to a small Association like theirs, which they had quite recently dubbed a District Association, asking a subscription to their funds.

Mr. A. Yuill (Dundee) thought an important question like this required plenty of time for consideration. On the first blush, he failed to see how they were going to derive any benefit from the change. Neither had they recived any inspiration from the mover of the motion. He was prepared to raise a point upon the legal aspect of the case; but they had learned that Mr. Carmichael had taken legal advice, and the Committee appeared to be sure enough of their ground. He suggested that they allow the question to lie on the table; and if the Committee thought it advisable to bring it before the next annual meeting, by that time they would have had better opportunities of studying the matter. Various items required consideration. For instance, some of them thought the word "Scottish" would be more comprehensive in dealing with that part of the United Kingdom; but let anyone go even no farther than to England, and write home to friends in Scotland, what did he put in the address? "N.B." This really indicated to all who were conversant with Scotland that "N.B." referred to Scotland; and what more did they require?

Mr. D. Vass (Airdrie) said he had intended to bring before them the subject in the way Mr. Yuill had done. The Association had a right to demand notice of an important motion like this. It was too much to spring such a question on the meeting. It was a fundamental principle of the Association that nothing of this sort should be carried without notice. Some of the arguments used in favour of the change he looked upon as rather in favour of the name remaining as it was than otherwise; but as he held that they could not discuss the subject without notice, he would not speak further upon it.

The President put to the members whether they wished the subject delayed; and there being no contradictory response, he declared this to be the finding of the meeting.

Proposed Formation of a Commercial Section.

Mr. Laurence Hislop (Uddingston) said the motion that was in his name was—"That it be recommended to the meeting that a Commercial Section be formed under the auspices of the Association, to assist the members in the advantageous disposal of bye-products, and in other ways to look after their interests." If, he said, they took, for instance, the matter of the disposal of coke, they would find members in the Western District often sent coke to the East and the North, and *vice versâ;* and the only people to reap benefit from this were the Railway Companies. Better means might also be found for the disposal of tar, and thus do away with the monopoly of the distillers. Sir George Livesey had given evidence to the effect that considerable increase might be obtained from organization of the tar business. They required a combination, or a Commercial Section, to protect their interests. In the Manchester and North of England districts they had combinations; and the result had been that managers there were never troubled with stocks of coke, tar, &c., and prices had greatly improved since the adoption of Commercial Sections. Many other things would be improved by such a combination—such as valuation, railway rates, and the like; and the cost of working a section would be very trifling in comparison with the results to be obtained from it. The representative from each town should be only the Engineer. He noticed that in the Manchester district they had a Committee of seven—six and a Chairman—and the Chairman must be a member of the Manchester District Institution. But commercial heads of gas departments might be members of the Section without being members of the Institution. This, however, was a mere detail. He thought the Engineers of the various districts were quite able to look after their interests in the Section; and if a Section were formed, and got into working order, he thought it would result in the greatest benefit all round.

The President said if he thought they were not going to adopt the motion, he would not second it. He seconded the last one, and they had delayed it for a year; but he would risk it again. He had very great pleasure in seconding Mr. Hislop's motion. He would say, in support of it, that Mr. Hislop had no axe to grind. He believed he had a very small stock of coke just now; therefore he would say that he was not acting in his own interests when he wanted a higher price. He would leave the motion to their own judgment, and hoped they would carry it unanimously.

Mr. A. Yuill said he was not like Mr. Hislop, because he thought that, as an Association, they should reap whatever benefits were going, as a whole. In this matter, various things required consideration. In the first place, if they were to have a bond of brotherhood, he supposed expenses would be incurred The question then arose, Were the Association to be liable for these expenses? or from what fund were they to be drawn? They could not be taken from the Benevolent Fund nor from the Research Fund; then from what fund were they to draw them? So, while in sympathy with Mr. Hislop's motion, he thought they ought to appoint a Committee to consider all the merits or demerits of the question, and to again bring the matter before all the members of the Association without deciding it. If Mr. Hislop was prepared to move that the matter be referred to a Committee, he was quite willing to support this; but he was not prepared to agree to the motion without fuller information.

Mr. Hislop said he would be most happy to do what Mr. Yuill suggested—in fact, this was his view of the matter to begin with, when he raised the subject in Committee. If it were left in the hands of a Committee, they could draft a scheme and submit it either to the Committee of the Association, or it could be left over to next year's meeting. If this met with the approval of the meeting, he would make the motion in this way.

Mr. Yuill, seeing that Mr. Hislop had not seen fit to move in these terms, moved that the matter be remitted to the President and the Vice-Presidents, together with six other members of the Association drawn from various districts in Scotland. In this way all the various interests would be represented; and their report could be circulated among the members.

Mr. S. Milne (Aberdeen) seconded. Remark, he said, had been made in regard to gas coke. So far as Aberdeen was concerned,

coke was coming from at least three gas-works, and he knew, from the prices they were charging in Aberdeen, they were not receiving 7s. per ton. He knew that there were canvassers for coke going over the North of Scotland. He thought that such action on the part of gas managers did not tend to the harmony which should prevail among them. For this reason he begged to second the motion.

Mr. HISLOP suggested to Mr. Yuill that his proposal would result in a very unwieldly Committee. He thought that if six members were drawn from different districts in Scotland, it would be less costly. A smaller Committee could be appointed quite irrespective of the Association Committee altogether.

Mr. YUILL thought they should have as wide a view as possible. He knew that sometimes people in the vicinity of Glasgow were troubled with a superfluity of coke from that district. His view was that anything coming under the Association should be considered by the Committee of the Association. In a question like this, it was only in the initiatory stage there would be outlay; and if his motion were carried, these expenses could come from the Research Fund in the inital stage. The Committee would be the advisers as to how the funds could be got for the working of the section. So he thought it would be much better to have the matter remitted to the Committee of the Association, and one or two others to assist them.

Mr. LIGHBODY asked the mover of the motion if he would give them a little more information as to whether, in the Manchester district, and the North of England district, the expenses were borne by the respective Gas Associations. He was led to understand that they were borne entirely apart from the District Associations.

Mr. HISLOP: That is so.

Mr. LIGHBODY considered that a Commercial Association should be formed in Scotland in the same way as in the South. He did not think it would be judicious for them to encroach upon the funds of the Association—either the Research Fund or otherwise.

The PRESIDENT pointed out that Mr. Lighbody supported the motion and Mr. Yuill also supported it, but wanted a Committee appointed to make investigations and bring forward a report at next year's meeting. He thought they should resolve in terms of Mr. Yuill's motion. They could quite well afford to have a large Committee who could frame a report and have it circulated before next year's meeting. In his opinion, they ought to have a fairly representative Committee.

This was agreed to; and the Managers at Glasgow, Edinburgh, Aberdeen, Dundee, Paisley, and Kilmarnock, were added to the Committee of the Association for the subject.

THE AUDITOR'S REPORT.

Mr. R. B. MAIN (Glasgow), the Auditor, submitted his report. It showed that the income of the General Fund for the year amounted to £105, and there was a balance of £3 19s.—a decrease of £2 4s. The income of the Benevolent Fund was £36 15s., and the expenditure £8 8s.; making an increase to the fund during the year of £28 7s., and during the past two years of £45 11s. The income of the Research Fund was £11 14s., and the expenditure £2 2s.; being an increase during the year of £9 12s. The total funds of the Association now amount to £566 9s., of which there is £373 10s. at the credit of the Benevolent Fund, and £180 15s. at the credit of the Research Fund.

Mr. J. NAPIER MYERS moved that the report be adopted, and that a hearty vote of thanks be accorded to Mr. Main for his labours. This was all the payment he received for his services, which were of very great value.

The PRESIDENT thought Mr. Main had placed the Association under a deep debt of gratitude to him.

The motion was adopted.

MR. YOUNG'S COMMUNICATIONS AND THE NAPHTHALENE QUESTION.

The President said there were two other matters arising out of the business of last year's meeting which had not been dealt with. First, there was the publication of Mr. William Young's communications to the Association; and, secondly, there was the naphthalene inquiry. Nothing had been done during the year on either of these subjects. It was well to mention this, so that the members might not forget them. He thought there would be a suitable opportunity shortly of having something done in connection with Mr. Young's communications.

PRESIDENT'S INAUGURAL ADDRESS.

The PRESIDENT then delivered the following :—

INAUGURAL ADDRESS.

Gentlemen,—Let me express my sincere thanks for my election a year ago to the honourable position which I occupy here to-day. In carrying on the work of the Association during the past year, I have been ably assisted by your esteemed Secretary and a strong Committee. I earnestly trust you will extend to me to-day the same loyal support and kind indulgence.

During the past year, and particularly within the past few months, we have sustained the loss of members who for a great many years had taken a prominent part in the proceedings of the Association. Mr. Robert Orr, senior partner of Messrs. Ross and Co., manufacturing chemists, Falkirk; Mr. A. S. Robertson, Gas Manager, Oban; Mr. John Macpherson, Gas Manager, Beith; Mr. Samuel Stewart, formerly Engineer and Manager to the Greenock Gas Trust; and Mr. James M'Gilchrist, Engineer and Manager of the Dumbarton Corporation Gas Department, have all passed away. What can I say in your name regarding the loss of our departed friends that has not been well expressed already? I can only voice the thoughts that are present to my mind. Mr. Robertson, though not a member of this Association, was well known and respected in the profession. The important work in which Mr. Orr was engaged for so many years is well known and recognized; and his memory will be cherished by all engaged in the manufacture of gas and in the chemical industry with which we are so closely allied. Mr. Macpherson's cheerful presence at our meetings will be missed. We remember Mr. Stewart for the gentleness which was native to his character, his integrity of purpose, and his loyalty and devotion to the profession which he adorned. He was disposed to take a generous view of his brethren, and to interest himself helpfully in their affairs. His conspicuous ability as an Engineer was recognized at home and abroad. Though quiet and reserved, his public utterances on those occasions when he was persuaded to take a part in our proceedings, gave evidence of speculative thought and breadth of view. He was President of this Association on two occasions, and a few years before his retirement was called to the chair of the Gas Institute. Before inventors of labour-saving appliances had perfected their schemes, Mr. Stewart predicted the successful displacement of arduous hand labour by machinery. His pioneer work in the introduction of the regenerator furnace to Scotland, twenty years ago, is a matter of history, and will be fresh in the memory of his contemporaries.

Mr. M'Gilchrist was a vigorous and public-spirited citizen, a man of strong mind and independent judgment, endowed with an unusual capacity for hard work; alert, capable, and resourceful; a leader of men who was able to attract hosts of friends and fellow-workers around him by his personal magnetism. As an Engineer, he was essentially practical, with a remarkable grasp of detail and a keen conception of the truth that "utility is economy in use." He displayed this in his work, whether as a Gas Manager or as a Consulting Engineer. His paper, entitled "Selling Gas," read before this Association in 1888, showed much foresight. Mr. M'Gilchrist will long be remembered for his many good and manly qualities; notably his large-heartedness, his genial disposition, and his devotion to the gas industry. He filled the President's chair in 1881, while still a young man, and again in 1894. His ability as an organizer was well exemplified in the large and increasing numbers of Scottish gas managers who turned out year after year to the Informal Meeting, initiated by him twenty-three years ago. He was for a considerable time a member of the Council of the Gas Institute, and among his brethren south of the Tweed he was cordially welcomed as a typical Scot. Those who formed part of that solemn procession which followed his remains to their last resting-place witnessed the most striking manifestation of public regard that it was possible to bestow upon anyone, however high his rank, however great his position, or however large a place he occupied in the affections of the people.

Your Committee, in their circular to members regarding the preparation of papers for our meeting from time to time, use a stock phrase, "the activity which characterizes the present period." These words have evidently been cast in a prophetic mould. They mark each successive year as more important than the last. The progress which the industry has made during the past decade is most remarkable, and that in every branch of the business. As Engineers we see it in improved design and method in construction; as Managers we find it in better working, more economical results, improved conditions of labour, and better wages for employees. In the distribution and sale of gas, and especially in the development of incandescent lighting, in maintenance work, inspection of consumers' fittings, and in the adoption of commercial methods generally, these years have witnessed unprecedented activity, largely increased sales, greater confidence, and altogether better relations between the gas supplier and the consumer; and, on the whole, there is an exceedingly bright and hopeful prospect for still greater advancement.

During the past year, new gas-works have been opened at Renfrew, Peebles, Gourock, Falkirk, Ayr (Newton), and Kelty; and important extensions have been effected in a considerable number of works. Labour-saving appliances have been introduced in the retort-houses at Alloa and Falkirk. In the former, the De Brouwer charger has been adopted, and in the latter Messrs. Robert Dempster and Sons' charger and discharger have been installed. These installations embody new principles and fresh features. Both are electrically driven, and mark an important departure in retort-house practice in Scotland; and the working results in each case will be followed with interest. The adoption by Mr. G. R. Hislop of the Temperley transporter, an electric power installation, for the handling of coke at the Paisley Gas-Works, calls for special comment. This scheme, which is the embodiment of utility, demonstrates the efficiency and adaptability of electricity to power purposes. The weight of the motor and overhead equipment is very much less than that of plant hitherto employed for such work, and a remarkable economy in structural steel is effected. The plant, though light, is substantial, and of pleasing design. The mobility of the carriage and its smoothness of working secure almost entire

absence of vibration, and should reduce wear and tear charges to a minimum. Those who have followed the study of this subject closely, and have observed the enormous weight of the structures set up to transport light material such as coke in small quantities by the continuous system of conveyor, or in larger quantities, for the most part never exceeding 10 cwt. at a time, must have been impressed with the cumbrous machinery employed in proportion to the load to be moved. The heavy oncost charges which such structures impose are in many cases so great, relatively to the saving which it is possible to effect, that a very small margin of profit is left after meeting interest and repayment of first cost; and this margin is often swallowed up in repairs and maintenance of the plant.

With regard to operations in manufacture, much good work has been done, and substantial progress has been made during the past year in the displacement of old or worn-out plant with appliances which experience elsewhere has proved safe and efficient. But very little pioneer work north of the Tweed falls to be recorded. We have all followed Dr. Bueb's results with vertical retorts on the Continent, and the progress made with the Woodall-Duckham installation at Bournemouth, and have also read, with pardonable pride and satisfaction, the contributions to this important subject by our friends and co-workers in Scotland, Messrs. William Young and W. R. Herring. The subject of vertical retorts is not yet of sufficient interest to the members of this Association to warrant us in dealing with it here and now. But it may be observed in passing that, apart from the utilitarian aspect of the question, or the possible development of the system, or some modification of it, to meet the requirements of small works, the study of the results obtained are most interesting and attractive from an educational point of view, and have already thrown striking side-lights upon our present system of carbonization; revealing the waste of material and energy in present methods, and indicating the possibility of increasing the production of gas and of the valuable residuals from the coal used.

In his able address to the Institution of Gas Engineers, Mr. Charles Wood emphasized the need for the discussion of subjects of particular interest to those engaged in the management of small works, and stated that out of a roll of 679 ordinary members in the Institution nearly 250 represented undertakings whose annual make of gas was less than 100 million cubic feet; while most of the papers read to the Institution were of a highly technical character, many of them being chiefly applicable to larger works. These are points which the bulk of the members of this Association will appreciate. Out of a roll of 155 ordinary members, only 16 are responsible for an annual output of more than 100 million cubic feet of gas. This reveals the truth of Mr. William Blair's remark at the last Informal Meeting, that "it was not every member of the profession in Scotland who could light up a few settings of twelves at a time."

To make these meetings of vital interest to the majority, it is desirable that the discussions should be productive of immediate and practical benefit. They should treat of plant, processes, and principles involved in the manufacture of gas on a small scale. At the same time, it is well to recognize the necessity for papers of a scientific and practical nature, particularly of research in any direction on the part of the members themselves; keeping in view the fact that the manager of small works is developing his knowledge and experience every day, is qualifying himself for a more important and responsible position, and therefore comes to these meetings with his mind prepared for instruction in the higher branches of his profession, as well as for mutual intercourse and discussion upon the by no means negligible matters affecting his daily work. The manager of small gas-works is placed in an advantageous position as regards close and constant personal supervision of the various operations and in getting out results at first hand—results which, in many cases, would be well worthy of rehearsal at meetings such as this. I would enjoin every manager to take this higher view of his responsibility to himself and to the gas industry; to treat the works at present under his charge as a laboratory where he has opportunities for research which will prove invaluable to him in the future—opportunities which he may not in after years have in any medium-sized or large works to which he may be appointed—and to bring the results of his experience before the Association in the form of a paper, however short.

A question which is of general interest and of pressing importance to a number of those present, is the lines upon which extensions should be made in order to provide for an increasing current output, and yet establish buildings and plant which may form an efficient and creditable part of a larger installation, should it be required in the future. This subject is of great moment in view of the growing demand for gas and the advent of charging and discharging machines suitable for small gas-works. To operate a discharging-machine, "through" retorts are necessary. "Through" retorts 20 feet long are not suitable for small works, and, in my view, are not suitable for the carbonization of Scotch coal, having regard to the destruction of the illuminating power resulting from the abnormal exposure of the gas to the heated walls of the retort. "Through" retorts are common in the South, and the results there are regarded as satisfactory. In England, the duration of charge ranges from 4 hours 48 minutes to 6 hours; and 17,000 cubic feet of gas per 20-foot retort per day is reckoned a good yield. But 15,000 cubic feet is perhaps nearer the maintainable average production; and this from coal producing 11,000 or 12,000 cubic feet per ton. At the moderate temperature necessary to produce these results, no physical difficulty would be experienced in the carbonization of Scotch coal in "through" retorts, whether there be one or two ascension-pipes to each; but if the high temperatures and large mouthpiece yields to which we have been accustomed are to be maintained, we must be prepared with a system of heating similar to that applied to inclined settings, so that, by an arrangement of ducts and dampers, the high temperature necessary for the efficient carbonization of the coal may be maintained uniformly throughout the length of the retort. In this case, each retort would have only one ascension-pipe, and the content of coal in the retort would be sufficient to reduce the space over the charge; thus preventing undue exposure to the heated walls, and accelerating the flow of gas from the retort as distilled. In any case, the second ascension-pipe is superfluous, as the gas never does divide from the centre of the retort, but selects the line of least resistance—the hydraulic main in which at the moment there is the least amount of "backing-up" of the liquor seal, or any main in which there is a slight accession of exhaust. The Dillamore tar-column—which is, I am persuaded, after five years' experience of its working, the best and most reliable seal-controlling arrangement on the market—will not, under the variations of working, equalize the seal at all points; and it is difficult to conceive of any retort-house governor which will maintain a more equal and consistent line in the hydraulic main than that which is attained in retort-houses with ample area of mains, efficient condensers, and exhausters working direct off a reliable equilibrium steam regulator.

In renewing some settings in Perth four years ago, one bed of eight "throughs" was tried—an experiment which failed. The object in making the change was to reclaim the space occupied by solid brickwork—namely, the 3-inch back wall of each retort and the packing between; thus adding 6 per cent. to the carbonizing area. But we found it difficult, with coking nuts varying from ½-inch to 2-inch gauge, to efficiently carbonize 18 cwt. per mouthpiece per day without pitching of the tars (each setting having a separate section of hydraulic main, this was immediately discovered); whereas with stop-ends, in the same setting, a maximum yield of 10,200 cubic feet per mouthpiece, or 20,400 cubic feet per "through" retort of 12 inches less length, has since been obtained without the slightest inconvenience. In other words, each pair of stop-end retorts carbonized 2 tons of nuts per day; whereas each "through" retort would not deal satisfactorily with 36 cwt. Therefore, so far as economy in production is concerned, whether as regards yield per mouthpiece or per ton, or maintenance of illuminating power, the advantage is all in favour of settings of "singles." To the manager in charge of works not sufficiently large for the introduction of "throughs," it must be gratifying to know that he is not labouring under a disadvantage in the working of single or stop-end retorts.

As environment affects the human character, so it influences gas engineering to some extent. In shaping schemes and laying plans, it is well to take notice of what is going on around. But in doing so it is wise to take a wide view, to look occasionally beyond the work of near neighbours, and keep in line with the best-known practice at home and abroad. Mr. F. D. Marshall, whose word carries weight, once counselled gas engineers, with graphic terseness, "never to employ an elephant to lift a pin." We are exposed to this danger only if we slavishly copy plant and schemes which have been designed to serve purposes entirely different from, or for work of greater magnitude than, that which we have in prospect.

Perhaps the finest example of a retort-bench suitable for present needs, and capable of extension so far as one can forecast future developments, and at the same time ready for the application of any kind of charging and discharging machines at present on the market, is to be seen at the new gas-works at Winchester. These are "through" retorts; but the length is only 10 ft. 4 in. over all. They are at present charged and drawn by hand, but are so arranged that when found expedient to employ machinery they may be charged and discharged from the same end. The advantages of such a system are obvious. Had the settings been placed back to back, two coke-conveyors would have been necessary, and the application of a discharging-machine would not have been possible with "singles." The system has other advantages—accessibility for examination, descurfing, &c.; and while forming an excellent and efficient unit of a comparatively small works at present, it may with advantage be extended as occasion requires to meet the needs of the district. Mr. Thomas Glover, in his paper on vertical retorts read before the Institution of Gas Engineers last month, stipulates for "the rapid elimination of the volatile products from the coal with as little exposure to the highly-heated surface action as is possible." The Winchester settings have evidently been designed with due regard to this well-known law, which has been accepted in Scotland for many years.

I have referred to the conservation of the illuminating power of the gas leaving the retort. In these days of incandescent lighting, the importance of this question is liable to be neglected. With incandescent lighting, which is now almost universal, there is no need for a high initial standard of illuminating power, as measured by the flat-flame burner; and tests made in this way may now be accepted only as an indication of the consistency of the gas from day to day, and its comparative value for incan-

descent lighting, and for cooking, heating, and power purposes generally. But the need for a uniform and consistent quality of gas is now more urgent than ever. I am afraid that exact means of testing candle power and heating value are not so general in Scotland as they ought to be; and as the time is past for rule-of-thumb methods, I counsel the regular and methodical use of the photometer and the calorimeter in small as well as in large works. Whatever the standard is, it should be maintained consistently from hour to hour. Only in this way is it possible to obtain uniform results in light, heat, and power from the nice adjustment of air to gas which is necessary to arrive at the highest efficiency. Uniform pressure at the consumers' premises over the 24 hours has also become necessary; the interval between the last demand at night and the first draught the next morning being so short in this age of day loads.

Why should there be a different standard of illuminating power in almost every town and village in Scotland, and so much inconvenience to manufacturers of incandescent burners, gas-fires, cookers, &c., in making suitable adjustment to the different qualities of gas supplied in each town? Is it not now possible to have a standard quality of gas for Scotland? This is a matter of supreme importance, and should be dealt with by this Association without delay—in the interest of consumers, in the interest of the gas industry, and in the interest of all connected in any way with the gas-fitting and gas-lighting trades. No corporation, however large, no works, however small, can produce a sufficient reason for the continuance of a special standard. The little Highland township of Aberfeldy, through the enterprise of the Gas Company, had its candle power reduced two years ago, every consumer having been supplied in advance by the Company with as many incandescent burners as he cared to order, free of charge. The labours of the London Gas Companies have culminated in the drafting of a model clause as to testing for the illuminating power of gas. This clause has been accepted by the Scottish Office as regards the testing of gas in Perth; and if the industry in Scotland is to benefit by the clause, we, as an Association, should adopt it. The acceptance of it by the Scottish Office establishes an excellent precedent. The clause will be found in an appendix to this address.

During the past year, four additional Scottish towns have followed the example of Paisley, and have abolished cooker-rents —viz., Dundee, Alloa, Arbroath, and Crieff. I have not figures before me for all the towns; but the results of the change in Dundee are remarkable. The following is a copy of the statement appearing in the printed returns:—

Cookers in use at April 30, 1905		2264
Appliances fixed at April 30, 1906—		
Cookers	3334	
Hot plates	392	
Grillers	1243	
Boiling-rings	815	
		5784

In addition to this, a boiling-ring is fixed in connection with every coin-meter, numbering 11,078. These figures are indeed remarkable; and Mr. Yuill is to be complimented upon the results of such enterprise. Out of 34,357 consumers in Dundee, 16,862 are now using gas for cooking purposes; and the price paid for the business has not been excessive, as the capital outlay is small compared with the number of new connections made.

It is in this direction, and by the introduction of gas-fires to public buildings, business premises, and occasional rooms in dwellings, that the principal increase in the sale of gas may be expected; and it is a profitable field. The gas-fire business in Scotland has not been exploited to any great extent. One cooking-stove is, of course, sufficient for each household, and, from one cause or another, a considerable amount of chopping and changing is inevitable in the cooker business; but the gas-fire is a permanent fixture. It is never in the way; it is rather a decoration when not in use; and the rent charged is so small that the fire is seldom returned between seasons. The domestic gas-fire has not hitherto been regarded as exclusively a day load; but the heating of offices and business premises provides a much better outlet for gas in the daytime than a cooking-stove, and in towns where both have been introduced, the average daily output is rapidly overtaking the maximum demand—a factor recognized as all-important in reducing the average amount assessed for fixed charges per 1000 feet of gas sold. To get the full benefit in this respect from increased sales, involves bringing up the day-load. If the increase comes upon what electrical engineers call the "peak of the load," extension of works is inevitable.

To arrive at a fairly reliable estimate of the value of new business, I have taken out some statistics relating to the gas supply in Scotland, which will be found in the appendix. The total increase in gas manufactured in Scotland during the ten years to 1905 is 49·81 per cent. In 23 towns of over 20,000 inhabitants, the increase is 45·49 per cent. for the same period. For short, I have accepted those as typical of the whole for purposes of analysis, and find that the mean average increase in the maximum daily make is 39·24 per cent., and the increase in capital expenditure 104·6 per cent. This indicates additional burdens for interest and redemption of capital sufficient to check the reduction in the selling price of gas which is naturally expected to follow a large increase in business; and it may partly explain why in one case, with an increase of 45·83 per cent. in the make, the price is the same as it was ten years ago, and in another instance, with an increase of 43·83 per cent. in the output, the rate has fallen only 1·3 per cent.

Going to the opposite extreme, we find in one case a reduction of 35 per cent. in the selling price with an increase of 59·74 per cent. in the annual manufacture. In this example, the reduction in price may be due to an entire change of policy as regards enrichment, and a better appreciation of the value of residual products in reducing the net cost of coal. Whatever the cause, the result provides an example worth following. In yet another town, with only 11,000 inhabitants, the price has fallen from 4s. to 2s. 2d. per 1000 cubic feet during the past decade—equal to a reduction of 45·83 per cent. Whereas at the beginning of the period under notice there was in Scotland only one town selling gas under 2s. 6d. there are now half-a-dozen. In the earlier period, there were only four rates of less than 3s. per 1000 cubic feet, while there are now 32; and within the past year or two rates as low as 1s. 6d. have been charged for trade purposes, in view of the competition of the suction gas-producer.

A uniform selling price for all purposes is most desirable; and to attain this the working expenses must be reduced to a minimum, and capital outlay directed with judgment and foresight. The burdens under which some undertakings are labouring render a low price all round impossible for many years to come. In one case particularly the cost of the gas delivered at the consumers' premises is 1s. 6d. per 1000 cubic feet; but with charges for interest, sinking fund, and taxes added, amounting to 1s. 3d., the selling price is 2s. 9d.—an average rate, and for lighting purposes comparatively cheap, but for power purposes too high. Under such circumstances, is a special rate for power purposes not

ILLUMINATING POWER OF GAS.

Perth Clauses as to Mode of Testing and Burner to be Employed.

[Draft.]

1.—The gas supplied by the Corporation shall, with respect to its illuminating power, be such as to produce, when consumed at the rate of 5 cubic feet an hour in the burner prescribed as hereinafter provided, a light equal in intensity to 16 sperm candles of six to the pound, and each consuming 120 grains an hour, and section 61 (Quality of Gas) of the Act of 1871, section 29 (Provisions Relating to Testing of Gas) of the Act of 1888, and section 45 (Quality of Gas) of the Act of 1897, are hereby amended accordingly.

2.—For testing the illuminating power of the gas, the burner to be used shall be that known as the Metropolitan argand No. 2, the photometer shall be the bar photometer, the standard light shall be that supplied by Harcourt's 10-candle pentane lamp, and in making the test the burner shall be so used as to obtain from the gas, when burned at the rate aforesaid, the greatest amount of light. Provided that the Board of Trade may, on the application of the Corporation or any five consumers, approve the use of any other burner, photometer, or standard light which may appear to the Board to be more suitable for the testing.

3.—If on any one day the gas supplied by the Corporation at the testing place is of less illuminating power to an extent not exceeding 1 candle than it ought to be under the provisions of this section, the average of all the testings made at such testing place on that day and on the preceding day and on the following day shall be deemed to represent the illuminating power of the gas on such one day at such testing-place.

ANALYSIS OF RETURNS FROM THE STATISTICAL REPORT OF THE NORTH BRITISH ASSOCIATION.

Years 1895 and 1905 Compared.

[Towns of over 20,000 Inhabitants.]

—	Per Cent. Increase in Annual Make in Ten Years.	Per Cent. Increase in Max. Daily Make in Ten Years.	Per Cent. Increase in Capital in Ten Years.	Per Cent. Decrease in Price in Ten Years.	Proportion of Maximum Daily Delivery to Annual Make.	
					1895.	1905.
A	42·53	38·61	101·9	16·60	1/194	1/200
B	28·91	29·97	236·5	8·30	1/196	1/198
C	39·13	30·17	9·7 (dec.)	20·00	1/175	1/187
D	54·75	37·99	118·6	15·00	1/181	1/202
E	50·48	22·66	19·4	3·13	1/183	1/196
F	46·31	34·00	100·6	13·16	1/196	1/198
G	82·81	69·18	99·8	24·40	1/182	1/197
H	85·90	80·00	117·6	13·30	1/176	1/182
I	126·58	103·25	122·2	24·40	1/174	1/183
J	82·85	59·74	63·6	35·00	1/178	1/198
K	80·90	43·83	207·8	Nil	1/188	2/211
L	63·64	45·83	22·5	1·30	1/183	1/195
M	45·55	65·01	24·5	15·50	2/213	1/188
N	73·14	53·66	81·3	23·26	1/183	1/184
O	70·99	72·41	350·4	20·00	1/182	1/191
P	53·32	46·28	125·8	15·00	1/188	1/192
Q	231·41	100·00	70·4	19·54	1/191	2/213
R	117·86	108·86	53·7	28·54	1/186	1/185
S	63·85	55·23	3·4	25·00	1/184	1/184
T	132·36	87·63	52·9	23·53	1/182	2/191
U	41·03	50·00	14·4	36·30	1/187	1/196
V	48·25	No return	246·3	12·50	2/192	..
W	169·56	134·61	135·0	16·60	1/179	1/188
Mean Aver. .	45·49	39·24	104·62	18·99	..	..

ANALYSIS OF RETURNS FROM THE "GAS WORLD YEAR BOOK."—YEARS 1900 AND 1905 COMPARED.

	Year.	No. of Consumers.	Per Cent. Increase in Five Years.	No. of Coin Meters in Use.	Per Cent. Increase in Five Years.	No. of Stoves in Use.	Per Cent. Increase in Five Years.	Total No. of Public Lamps.	Per Cent. Increase in Five Years.	No. of Incandescent Public Lamps.	Ratio of Increase 1905 over 1900.	Consumption per Consumer.	Per Cent. Decrease in Five Years.
United Kingdom	1905	5,260,747		1,928,161		1,789,616		702,980		367,753	2·77	33,969	
	1900	3,879,439		785,264		837,253		618,669		97,372	1	40,383	
		1,381,308	35·60	1,142,897	145·54	952,363	113·74	84,311	13·63	270,381		6,414	15·88
Scotland	1905	717,539		79,566		80,904		86,005		41,318	12·58	21,045	
	1900	610,328		31,173		45,366		82,963		3,041	1	21,821	
		107,211	17·56	48,393	155·24	35,538	78·33	3,042	3·66	38,277		776	3·55
Ireland	1905	134,093		37,532		32,452		26,542		5,756	3·85	37,242	
	1900	106,400		7,895		14,719		24,686		1,184	1	41,807	
		27,693	26·02	29,637	375·39	17,733	120·48	1,856	7·52	4,572		1,565	10·92
England and Wales	1905	4,409,115		1,811,063		1,676,260		590,433		320,679	2·44	35,972	
	1900	3,162,711		746,196		777,168		511,020		93,147	1	43,918	
		1,246,404	39·40	1,064,867	142·70	899,092	115·68	79,413	15·48	227,532		7,946	18·09

justifiable? I think it is, "provided that the rate charged for gas so supplied shall be the same to all persons under like circumstances." The policy of granting special rates for day consumption is also defensible, on the ground that the profit arising from such business, and from all new business which does not necessitate fresh expenditure upon manufacturing and distributing plant, forms a contribution to the relief of the general rate.

I had hoped to deal at greater length with the statistics in the appendix—more particularly with the facts which they disclose. These tables may, however, be more conveniently studied by the members; and the figures will, I trust, be of some service, by way of comparison, and perhaps of emulation.

In reviewing the work of the past year, so far as I have been able to do so within the scope of my address, I have found it rather difficult to eschew controversial subjects; but I trust the importance of the questions raised is sufficient to justify the references made. Precedent, unfortunately, debars you from discussing the address; but, so far as I am concerned personally, I shall have great pleasure in relaxing the rule, so that the address may be discussed, should time permit.

Mr. W. R. Herring (Edinburgh) proposed a hearty vote of thanks to the President for the very able address he had just concluded. He was sure the members had all been delighted with the grasp he had of the business, both from the practical and the commercial point of view. His opinion also, as regarded those further interests, from the consumers' point of view, were to him perfectly correct. They must look, in the future, to their consumers, and treat them in an ordinary commercial way, as though they were dealing in an ordinary shop—as if they were selling something over a counter, and the consumers buying it—and they must give them every attention. The President was even so bold as to suggest that he would like his address discussed. That, perhaps, would be a little unfair to those who were to follow him in the chair. It was all very well for Mr. M'Lusky, who was so able in dealing with matters of this sort, to open up his address for discussion; but it was quite possible that some of those who might have to follow him would be in a very awkward corner indeed if they had to sit down and write an address which was to be open to the discussion of the meeting. The President had, however, touched upon one or two points in his address which were of extreme interest. The advice to those who were in smaller works that they should treat their works as a research laboratory, was indeed most excellent. Really, where the higher research was concerned, it must be admitted that they did not know very much about what they were doing. The complex character of what they called the hydrocarbon series was very little understood by the scientists of the day. Now, if everyone of them was to treat his works as a research laboratory, there was no doubt they would all find out things which, when put together, would form a most important clue to some of the mysteries they now suffered from. Then the President's reference to the suggestion of a standard illuminating power for Scotland was a most important one, and his reasons most excellent. Everyone present knew that they had the greatest trouble in getting apparatus from English makers suitable for the gas they manufactured. There was no need for the high illuminating power they furnished; and if they could make Scotland unanimous on this question it would be an advantage. Local circumstances must always sway; but still they might get nearer than from 15 to 30 candles. He begged to compliment the President upon his able address.

The President said he felt flattered indeed at the very complimentary remarks Mr. Herring had made upon his humble endeavour that morning. The best way of showing his gratitude to Mr. Herring was to call upon him to read his paper on a most important subject.

Reading of Papers.

Mr. Herring's paper was then read and discussed—see p. 316. After the luncheon adjournment, the paper by Mr. Lighbody (p. 323) was taken, and subsequently that by Mr. Napier (p. 306). The report of the discussions on the last two papers is deferred till next week.

Election of Office-Bearers.

The President announced that, as the result of the ballot, the following had been elected office-bearers for the year:—

President.—Mr. Laurence Hislop, of Uddingston.

Vice-Presidents.—Mr. William M'Crae, of Falkirk, and Mr. W. Blair, of Helensburgh.

Members of Committee.—Mr. J. Gibb, of Newton-on-Ayr, Mr. A. Yuill, of Dundee, Mr. J. D. Smith, of Stirling, and Mr. A. Waddell, of Dunfermline.

Secretary and Treasurer.—Mr. R. S. Carlow, of Perth.

Auditor.—Mr. R. B. Main, of Glasgow.

Next Place of Meeting.

The meeting next year is to be held in Glasgow.

Votes of Thanks.

Mr. S. Milne proposed a vote of thanks to the readers of papers. They had, he said, enjoyed quite a treat. The first paper, read by Mr. Herring, was an interesting combination of facts which had been the result of much careful research. They were exceedingly indebted to him for bringing such a mass of useful information before them. The other two papers had been of a more constructive order, and contained, also, much valuable information; and he was sure they would find more in them than they had up to that moment.

The proposal was agreed to.

The President's Medal.

Mr. J. W. Carmichael, as Past-President, presented the President's Medal of the Association to Mr. M'Lusky. The medal was the highest honour the Association could give, and he was sure that Mr. M'Lusky had made an excellent Chairman. They were all well acquainted with the steady progress and advancement he had made in his profession; and now he held the honourable position of Engineer to the Commissioners of the Fair City of Perth, by his perseverance, and by his qualifications, as well as by his sound business judgment, and thorough knowledge of his profession.

The President, in returning thanks, mentioned that their late respected friend, Mr. M'Gilchrist, once said of him that he had played for the position. He admitted that he had; but at the same time he convinced Mr. M'Gilchrist, in private, that he felt he would have been better if he had had other five years or so of an apprenticeship.

Mr. C. P. Myers (Troon) proposed a hearty vote of thanks to Mr. Carlow, the Secretary and Treasurer, for so ably carrying out the duties of his office.

Mr. Carlow acknowledged the vote.

Proposed Memorial to Mr. J. M'Gilchrist.

Mr. A. Yuill said that, before they separated, he thought they had a further duty they should take upon themselves. While they shared in the pleasures which their annual meetings brought to them, they had that day been reminded of the griefs which they sometimes were called upon to suffer—by the loss of old friends. He referred more particularly to their late departed friend Mr. M'Gilchrist. The members of the Association would no doubt feel a pleasure in being able to contribute, in some way or other, to a scheme for perpetuating the memory of Mr. M'Gilchrist, and

SOUTH FRONT—GRANTON GAS-WORKS.

he thought that, as an Association, they ought to remit to the Committee to devise some means towards this end. He moved to this effect.

Mr. C. P. MYERS seconded; and the motion was cordially agreed to.

The PRESIDENT, speaking on the subject, said he presumed it was an open secret that the Committee had had this matter under their very serious consideration. The question was how best to perpetuate the memory of their departed friend. They thought of founding a University scholarship; they thought of approaching the Town Council of Dumbarton with regard to their opinion as to the erection of a tablet somewhere in Dumbarton; they thought of approaching the authorities of the Glasgow and West of Scotland Technical College, with a view to founding a scholarship there; another proposal was to have a medal or medallion in connection with the Informal Meetings of Gas Managers, to be presented to the President of the meeting; and yet another proposal was to offer a gold medal to the Scottish Junior Gas Association, to be competed for annually, and to be awarded to the student who came out at the top each year. He mentioned these matters so that they might consider them. He suggested that they should appoint a Committee and give them either limited powers or full powers in the matter. Perhaps Mr. Yuill would say whether his proposal was to remit the matter to the Committee of the Association, or whether he proposed to have other members of the Association acting with them.

Mr. YUILL said he thought it would be better to leave the matter in the hands of the Committee of the Association.

This was agreed to.

The members and lady friends, to the number of over 100, afterwards dined together in the Balmoral Hotel—Mr. M'Lusky in the chair. The only toasts proposed were those of "The King," "The Ladies," and "The Chairman." The last was proposed by Mr. A. MacPherson, of Kirkcaldy, one of the Honorary Members of the Association, who spoke a few complimentary sentences in support of his toast, which was enthusiastically honoured. The weather being beautifully fine, the company dispersed at an early hour, so as to enable them to participate in the joys of the city.

On Friday forenoon a party of about eighty went for a drive to Queensferry, to see the Forth Bridge—passing, on the way, through the grounds of Dalmeny, belonging to the Earl of Rosebery. Luncheon was served in the Balmoral Hotel, on the return to Edinburgh; and at 2.45 a special train from the Caledonian Station conveyed a very largely augmented company of ladies and gentlemen to the gas-works at Granton. There they were met by Mr. Herring and his staff; and, after a photograph had been taken, they walked through the retort-house to the new technical office, where they sat down to enjoy tea and other light refreshments.

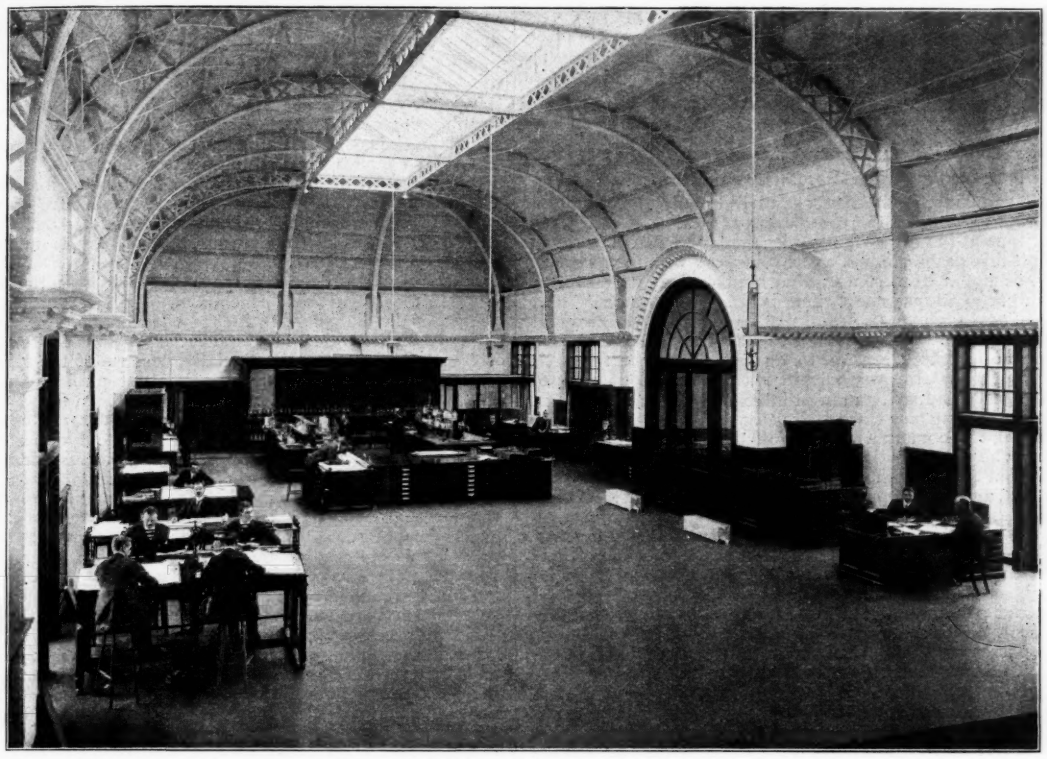
Mr. HERRING extended a hearty welcome to the company. It was, he said, regrettable that the visit had taken place during the Edinburgh holiday time, as several of the Commissioners much regretted their inability to be present to welcome them. But he could assure them that they had the good wishes of the Commissioners, who had instructed him to do everything he could to make the visit an enjoyable and pleasant one. They were to understand that they were at liberty to go to any part of the works they might fancy, and at most of the important points members of the staff would be stationed, who would give them every assistance and information they might demand from them. The place was at their service that day.

The PRESIDENT (Mr. M'Lusky) said they congratulated themselves that they had such a large gathering at their meeting the day before; and they asked each other what was the cause of it. He thought the large gathering at Granton that day explained how their meeting in Edinburgh had been so popular, and so well attended. It was quite clear to him that the attraction of a visit to the Granton Gas-Works had been sufficient to provide them with a record party at their annual meeting this year. It was very gratifying, indeed, to find gas managers and their friends in Scotland taking such a vital interest in the Granton works. It was a sign of the times; it was a sign of the desire of everyone to see the most modern gas-works extant. He asked the members to send to the Edinburgh and Leith Gas Commissioners (through Mr. Herring) a message of thanks for the very cordial reception and hospitable entertainment they had received.

Mr. HERRING, on behalf of the Commissioners, returned thanks. They were, he said, always glad to see visitors at the works. It was a standing order that any gentleman coming to the gate and presenting his card—showing that he was connected with a gas-works—had *entrée* to the works at any time. He had felt it an honour that they had selected Edinburgh as their place of meeting, and that they should have thought it worth their while to visit the Granton works. He felt it an honour to himself, and he would like to express his thanks to the staff for so ably assisting him in receiving them, and in conducting them round the works.

The company then dispersed, and wandered over the works at will. Unfortunately, drenching rain was falling, which prevented many (especially the ladies) from going far afield; but many of the male members of the party made an interesting tour of the works. When the special train started on its return journey to Edinburgh, Mr. Herring was left alone on the platform, and, as a parting greeting, a hearty cheer for Mr. Herring and Granton was raised. The company broke up, with much hand shaking, on the platform of the railway station in Edinburgh.

The Granton works, since first put into operation on Oct. 22, 1902, have grown considerably greater, so far as a visual examination discloses, than the actual manufacturing capacity reveals, in consequence of the second section of the works being now fast approaching completion. Upon closer examination, the fact is disclosed that, while the structures and buildings are erected for the complete section, it is being only half equipped with plant at the present time.



THE NEW TECHNICAL OFFICE AT THE WORKS,

Within which the Members of the Association were received.

[This technical office comprises at either end photometer rooms (one official and one experimental), chemical laboratory with balance room, drawing office, and statistical clerks department, housed within a building of exactly similar design to the station-meter house and pumping-station. Ultimately this building will be used as a station-meter house. Beneath the first-floor level, the space is occupied with coal-testing plant for the two sections (one on a small scale, and one on a large scale), together with gasholders, &c., complete, tar still, and other apparatus for research work.]

The general appearance of the works, as seen from the highway, if it were not for the gasholder in the background, would not convey to the observer the impression of their being a gas-works. The whole characteristics of the place differ materially from what such works usually are. The appearance is even somewhat pleasing to the eye, as will be seen by the photograph of the southern elevation of the works. The photograph naturally suggests that a large sum of money has been spent in acquiring the architectural features illustrated. Upon inquiry, however, we are assured that the buildings have, on the contrary, cost a very moderate sum of money as compared with similar buildings elsewhere. We are told that the retort-house blocks have cost at the rate of 2d. per cubic foot of structure complete, and the coal-store blocks 1·86d. per cubic foot for the two sections respectively. Seeing that ordinary buildings of the simple warehouse type are scheduled at 4d. by architects and valuers, the characteristics of Granton may be said to be not only pleasing, but also to have been brought about with due regard to economy. It is probably known that the works and all appertaining thereto is to form the subject of a book comprising a re-issue of the articles which appeared in the "JOURNAL," written up to date, and embodying all details with regard to the second section of the works.

In fitting up the second section, little change has been made from the lines laid down when first planning the works. The results, from the manufacturers' point of view, have been so highly satisfactory as to make it difficult, if not dangerous, to deviate much from the lines of what has already proved itself to be such an economical and successful installation. Detail improvements have, however, been made in some of the plant, which experience has shown to be advantageous; but they are not of such a character as to call for serious consideration at the present stage.

It is now four years since the plant was first put to work. The coal used has realized an increased production of gas over what was formerly obtained at the old works—viz., 10,438 cubic feet per ton in 1904; 10,802 feet in 1905; 10,973 feet in 1906.

The labour costs over the whole works, with wages on a higher scale, are remarkably low. Under the heading of carbonizing, Mr. Herring includes all foremen, coal unloading, breaking, elevating, storing, charging, and drawing retorts, pipe-jumping and repairs to retorts, producer and ash men, hot-coke conveyor, and attendants at the engines driving the coke and coal handling plant. The entire costs for the year 1904 were 1·482d. per 1000 cubic feet, for 1905 1·3d., and for 1906 1·28d..

The whole costs or manufacturing charges—including attendance to exhausters, washer-scrubbers, boiler-men, syphon-men, locomotive men and shunters, gasholder and pump-house men, handling ashes, water-pumps, and also labour in purification, and such items as office staff, weighers, store-keepers, yard cleaners, &c., amounted in 1904 to 2·44d., in 1905 to 2·08d., and in 1906 to 1·99d. per 1000 cubic feet. In other words, the entire manufacturing costs—which may be said to include items some of which are commonly charged to the repairs and maintenance account—sum up to the remarkably low figure already named.

The costs as to construction and equipment of the works are not at the moment completed. The first section is reported to have cost £450,000, or at the rate of £45,000 per million cubic feet daily capacity. We are informed, however, that this figure includes a sum of £27,000 that is represented by floating stock, renewal parts and railway rolling stock, and which, upon the completion of the second section of the works, will be credited to capital account, as it has no direct connection with the manufacturing plant until it is employed.

The second section of the works, which is to be formally opened in October next, is being equipped with inclined retort carbonizing plant capable of dealing with 500 tons of coal per diem, together with automatic coal unloading, breaking, elevating, and storage plant, hot-coke conveyors and ash-handling plant, water-tube condensers, steam-driven gas-exhausters, Pelouze and Audouin condensers, Livesey type washer, Holmes's scrubbers, and cyanide plant, together with a set of six purifiers and station meter, all of which are designed for dealing with a maximum daily production of 5 million cubic feet.

A Projected Balloon Race at Reading.

Last Saturday a "hare and hounds" balloon race was to have taken place from the Reading Gas-Works; but, unfortunately, owing to the high and gusty wind, the event had to be abandoned. In spite, however, of the fact that the race was declared off, all the six balloons, which were to have taken part in it, ascended, and quickly sailed away from view. It is stated that four of them later on descended in the neighbourhood of Hitchin and St. Albans. The total quantity of gas used for filling the six balloons was about 260,000 cubic feet; and Mr. Douglas Helps, the Gas Company's Engineer, found that they could fill a 50,000 cubic feet capacity balloon in about 25 minutes. Naturally the projected race (which was organized by the Aero Club) caused a considerable amount of interest; and our contemporary the "Daily Graphic"—who, by the way, published yesterday some capital illustrations of the balloons—states that between 7000 and 8000 people assembled on the Gas Company's premises and along the banks of the River Kennet.

DE BROUWER STOKING MACHINERY AT ALLOA.

By J. W. Napier, Alloa.

[A Paper read at the Meeting of the North British Association of Gas Managers.]

Consideration of circumstances peculiar to each gas-works must be taken into account when discussing the introduction of machinery to supplant hand labour; and it is only the intention of the author to describe the installation of stoking plant of the projector type at the Alloa Gas-Works, the experience in working, and the resulting saving in wages, as compared with hand labour. It should be stated, at the outset, that the principal reasons that led the author to adopt some system of mechanical stoking and handling of coal for a works of the size in question, were several —namely, the desirability of being less dependent on stokers as a sole means of working retorts, to do away with the repeated handling of material, to overcome, in part, the arduous work of the retort-house, and last, and most important, to benefit the Gas Department in monetary saving of wages.

In bringing this communication before the members, the author desires it to be clearly understood that machinery and plant have been installed to deal with the coal only as it is received into the retort-house, and for the purpose of charging the retorts. Opportunity for dealing with the drawing or pushing of coke from retorts, and other coke-handling plant necessary, is placed in reservation for future application; and in this matter, as an instance of how circumstances may differ in gas-works, at Alloa, after the coke has been placed in the yard, fully 90 per cent. of the total quantity sold per annum is disposed of locally—the remaining 10 per cent. only requiring to be put in trucks for shipment. There is, therefore, a minimum amount of labour required in the disposal of this product.

The question will, doubtless, have been raised as to the advisability and possible economy of installing machinery in a works carbonizing about 12,000 tons of coal per annum, having regard to the general fact that only in very large works has stoking machinery been found practicable from a financial point of view. In this important phase of the matter, the author determined that two considerations were necessary. First, the plant installed should represent a minimum in capital expenditure; and, secondly, the all-important item of repairs and maintenance should be reduced to within small limits. Hitherto, and until the type of projector plant was introduced, power stoking was carried out chiefly by the West and Arrol-Foulis machines; and these have been found eminently successful where introduced on a scale sufficient to keep them well employed.

These plants, it is hardly necessary to mention, are altogether out of the question for a comparatively small works; and it is undoubtedly the case that for several years a simple and inexpensive power-plant for retort-house work was much required for undertakings of medium size. In this matter, gas-works have not shown the same advance in manipulating the dead-weight material—coal—as is the case in other industries. It has been argued time and again, from certain well-known sources, that the man with the shovel cannot be beaten—that stoking under his care is nothing less than a fine art. This can, and must be, in the opinion of the author, mere general deduction, as the stoker differs much in type and efficiency, and, however expert in isolated instances, does not provide the same absolute certainty of action as can usually be obtained by a mechanical appliance.

The plant about to be described meets in a very satisfactory manner the several requirements desired; and, while conscious that retort-house practice is the pulse that energizes the whole work in making for success, it is satisfactory to know that the scheme adopted has fulfilled the expectations first formed. A short description only of the plant is necessary at this time, as most of the members are already familiar with its construction from detailed descriptions in the technical journals. It is well to state, at the outset, that, as regards the retort-house, no structural alteration of any importance was found necessary. It will be observed from the drawing that the walls of the house are somewhat low, being only 17 feet to the eaves; and this had the effect, so far, of cutting down the height of the machine, with self-contained hopper, to permit of it passing round the house.

The bench consists of eight ovens, having eight retorts in each setting, and put back to back, together with three ovens with six retorts in each, used chiefly as a stand-by. For reasons which need not be discussed at this time, it was resolved not to convert the bench into "throughs," as might easily have been done, but to adhere to the present arrangement of back-to-back; the retorts being 9 ft. 3 in. long and 14 in. by 22 in. in cross-section. It has been found of advantage to adopt a different section of retort—viz., 16 in. by 22 in.—which permits of the coal, when projected from the belt, more freely entering the mouthpiece, with the advantage of the additional height of 2 inches.

The auxiliary plant consists of a coal hopper, breaker, and elevator. The hopper is on a level with the retort-house floor, with the coal-breaker underneath; and the coal is tipped into it from carts. The breaker is provided with suitable adjusting arrangements to give coal of any desired size. The elevator delivers the coal into an overhead storage hopper of 12 tons capacity. It is the intention to erect another hopper of similar or larger capacity, and thereby gain the advantage of less frequent elevating of coal being necessary. The hopper is divided into two sections; this arrangement admitting of nuts or any particular coal being kept separate, if desired. A 25½-brake-horse-power gas-engine of the electric lighting type drives the breaker and elevator by means of shafting, belt-driven from the engine. A 9 kilowatt dynamo, giving continuous current at 220 volts, is coupled direct to the engine with a flexible coupling, and supplies the current for the motors on the machine. From the switchboard, provided with ammeter and volt-meter, the current is taken through two overhead bare copper conductors running from end to end of the retort-house, and from which, by means of trolley arms, the current is taken to the motors on the machine.

The projector proper is very simple, and presents no intricate details of construction. It consists of a large grooved pulley, 39 inches in diameter, 15 inches wide on face, and having a groove 8 inches wide and 5 inches deep. This depth of 5 inches is greater than is used in England, because of the difference in the coal. In England, large coal is not used to so great an extent as is the case in Scotland. It has been found by experiment that, if the groove be made much wider, the coal flies off the belt in a more scattered manner, without entirely entering the retort. The endless rubber belt, 15 inches wide, having a raised path ⅜-inch thick, where surface contact with the coal takes place, is carried round three pulleys, and also partly round the large grooved pulley. This belt is made of rubber; and experience at Alloa and elsewhere has amply and thoroughly proved this material to be satisfactory in a very high degree. In order to tighten the belt, which is necessary from time to time, tension is obtained by one of the band pulleys being fixed on a spindle running on bearings, sliding parallel to each other, and fitted with screw regulating gear. If the belt is allowed to get too slack, the wobbling action causes the coal to be projected in an undulating stream, and so it falls short of the proper distance to the back-end of the retort. A 3-horse power motor for driving the projector belt is enclosed at the front of the machine, and started and controlled by a switch and rheostat.

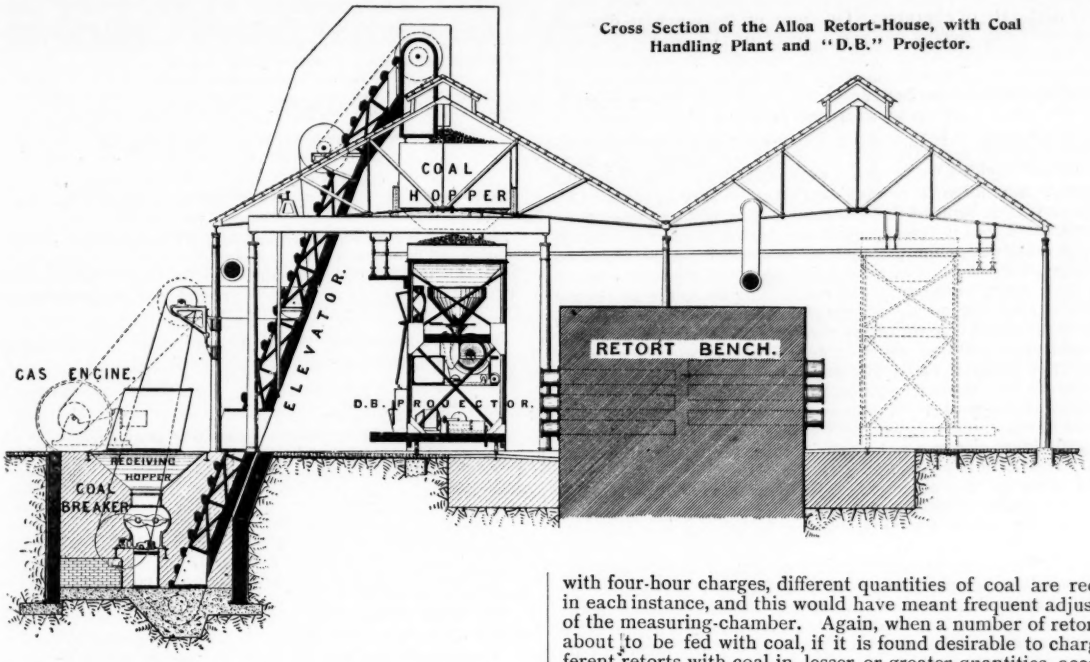
The projector is raised, lowered, and adjusted to the various tiers of retorts by means of chains passing round a drum working in a cast-iron frame, and driven by gearing from a 7-horse power motor. The same motor also propels the machine for travelling; a clutch being in use, and so arranged that the whole structure can travel in either direction, or the projector be raised or lowered by the operator on the platform working the controller, of the usual tramway type. The projector, as will be observed, is of the travelling type; being carried by a strongly-braced framework of channels and angles, and carrying a 2½-ton coal-hopper, the whole mounted on wheels running on rails in front of the bench. It is a matter for consideration whether a projector suspended from hanging brackets, having a coal-conveyor and small hoppers opposite each oven to feed the coal direct into the machine, should be installed, or a machine as has been described, with a stationary hopper. With the suspended form of machine, the additional cost for extra hoppers and coal-conveyor must be considerable, and as regards the Alloa works would have meant a much increased first cost. It will be observed from the diagram that a measuring-chamber is fitted on the machine, by means of which the weight of each charge of coal is determined. After a short experience of working the machine, a measuring-chamber was found quite unnecessary; and it was removed.

There are two special features about the machine as in use at Alloa. An automatic feeder has been fixed for regulating the flow of coal on to the band of the projector, consisting of a serrated roller arranged at the outlet of the coal-hopper, and made to revolve by means of an electric motor which is geared down by a worm and worm-wheel running in an oil-bath. The motor is of the "variable speed" type, so that the coal which passes over the roller may be made to flow faster or slower as may be required. In addition to the "variable speed," the flow of coal may be reduced or increased by means of an adjustable hinged plate arranged at the mouth of the opening, so that the latter may be regulated to suit the various classes of coal to be dealt with. Directly over this roller-feeder, a slide door for starting and cutting off the flow of coal is arranged, and is operated (by means of a suitable hand-lever) from the platform.

The other special point about the machine is that it is arranged to charge the stop-end retorts from both sides of the retort-house. This is carried out by having the rail-track upon which the machine runs arranged in a semicircle at the end of the house. The radius of the inner rail of this track is 15 feet; and in order that the machine could travel round so small a curve, the following special arrangements had to be made with the wheels and axles: The outer wheels on the driving and trailing axle are keyed to the shafts in the usual way; but the inside wheel on the trailing axle is bushed, and runs loose on the shaft, while the inner wheel on the driving axle also runs loose on the shaft, but is geared with the shaft by means of a set of differential gear, to allow for any alteration in the relative speeds of the two travelling wheels, which will vary with the radius of the curve.

The operation of charging may be shortly described. With the hopper on the machine filled with coal, the operator starts the motor for driving the broad belt, and moves the handle of the rheostat to give the speed necessary to project the coal to the back-end of the retort; the speed-rheostat being numbered to enable any desired speed to be obtained. The lever to operate

Cross Section of the Alloa Retort-House, with Coal Handling Plant and "D.B." Projector.

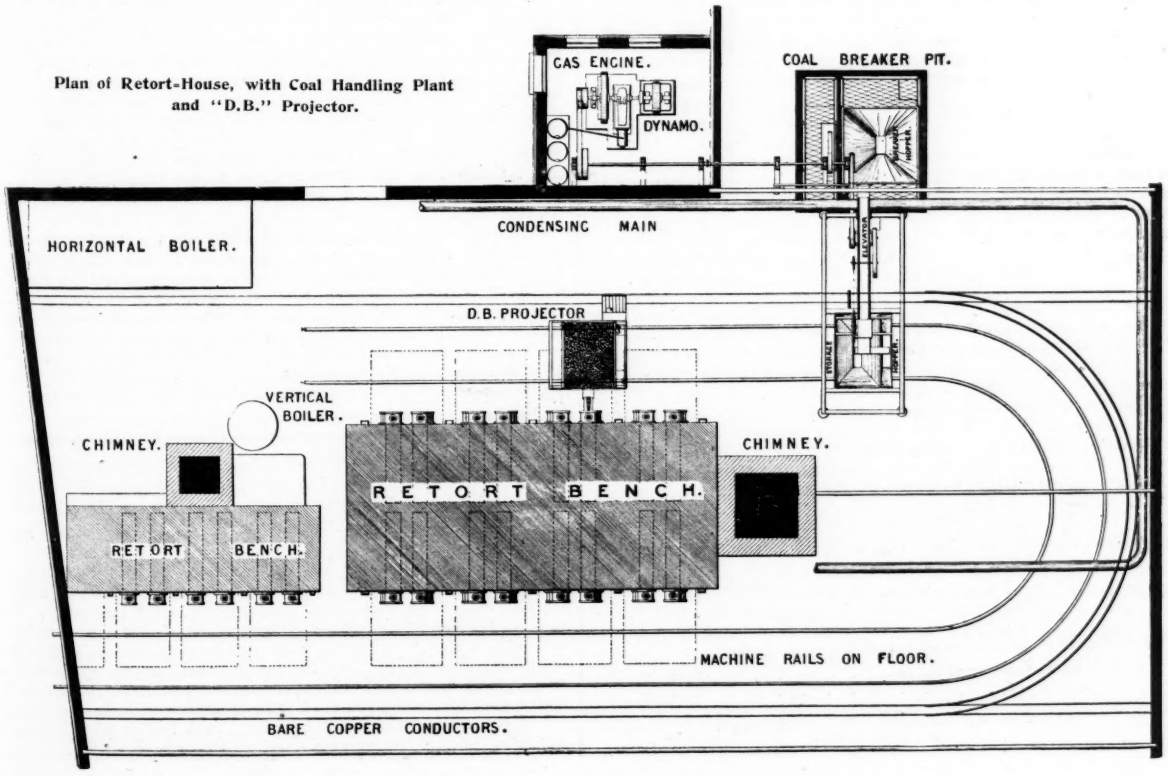


the outlet of the measuring-chamber is then pulled up, and the coal, falling into the groove on the wheel, is kept from flying off the belt by the latter running on the outer peripheries of the large wheel. The coal is carried on the belt until the latter suddenly changes its direction. The coal is then projected in a straight line into the retort, and by force of gravity strikes the bottom of the retort a short distance from the mouthpiece, and comes to rest at the back-end. As the operator reduces the speed of the motor, the speed of the belt also becomes less, and likewise, therefore, the distance to which the coal is thrown; while the coal gradually fills up the floor area of the retort, until, when the mouthpiece is reached, the operator shuts the lever feeding the coal from the hopper. The principle of the working of the projector is simply that a certain impetus is given to the coal lying on the belt by the velocity at which the belt is travelling.

Considerable doubt might be experienced as to being able to get satisfactory results without the aid of a measuring-chamber to guide the stoker as to the proper amount of coal to be put into each retort. Opinions may differ in this matter; but at Alloa the measuring-chamber was found of no advantage, but rather the reverse, and that for several well-defined reasons—namely, charging the centre retorts every three hours and the side retorts with four-hour charges, different quantities of coal are required in each instance, and this would have meant frequent adjustment of the measuring-chamber. Again, when a number of retorts are about to be fed with coal, if it is found desirable to charge different retorts with coal in lesser or greater quantities, according to the condition of temperature, the operator is left free to do so, and at the moment. In other words, he can charge the retort in a manner satisfactory to the conditions, with the same judgment as the man with the shovel. This, at least, has been the experience at Alloa.

With very little practice, there is no difficulty in forming an even layer of coal along the whole length of the retort; the operator slowing down his motor at the proper rate. If this is not done, the coal heaps up in an undesirable fashion; while, if the motor is slowed down too quickly, a thin layer of coal in certain places results. Using large coal, a greater speed of the belt is necessary than with nuts, as the latter, being clean and light, do not require the same propelling force. Wet coal or nuts in similar condition merely require the necessary difference in speed to ensure satisfactory charging, the material in that condition being heavier. Elongated or thin slab pieces of coal about 8 inches to 10 inches in length, which escape the coal-breaker, have several times found their way right through to the machine; and in descending from the hopper, should they fall in a direction horizontal to the deep groove on the wheel, the flow of coal is stopped for the time being. The operation of charging a 9-foot retort takes about 9 seconds, with 3 cwt. charges. This

Plan of Retort-House, with Coal Handling Plant and "D.B." Projector.



time has been lessened; but it is not desirable to work at an unduly high rate of charging. One man on the machine does all the charging and closing of doors, except in the winter months, when the doors are closed by the man who also does the drawing. The machine man starts and stops his engine and elevates all the coal tipped into the hopper.

Shortly after starting to work the projector—the installation being ready early in November of last year—considerable trouble was experienced in attempting to charge with large coal, more especially if slightly wet. They were, therefore, obliged to use nuts only, or a mixture of nuts and dross. This apparent first drawback was no fault of the machine proper, but was due to the large pieces of coal in the aggregate coming together at the mouth of the coal-hopper at the point of delivery to the machine, and so preventing the even flow of material; the result inside the retort being that, owing to the supply of coal falling on to the belt being stopped during the period of charging, the motor got up speed and brought about unsatisfactory results. This factor was a very important one in influencing to an undesirable extent the make of gas per ton, as splint being the staple coal in use a much better yield can be got than with nuts or other small coal—a result common to most gas-works. It may be mentioned at this stage that the coal-breaker, more especially when any soft splints are being dealt with, gives rise to a not inconsiderable proportion of dust or small. With coking coals, this defect is of no moment; but in the case of some splint coals having little or no coking action in the retort, the effect is to produce a not inconsiderable amount of breeze in the coke—a slightly less make of gas per ton also resulting.

The plant has now been in constant operation for six months; and the following particulars of working are of value. No trouble whatever has resulted as regards the retort-house staff; the stokers having taken kindly to the machine and appreciated the advantages to them personally. This feature must not be considered too unimportant. Anything which tends to eliminate hard and arduous manual labour is bound to reflect a large measure of good on the individuality of the stoker, which he is not slow to appreciate; and at the same time observation enables one to say that he is more contented. No breakdown of any moment has occurred to cause inconvenience; what little trouble has been experienced being chiefly due to electrical connections getting burned out. The several operators on the machine are ordinary stokers; and it may be frankly stated that no special skill is required—a few days' training being all that is necessary to ensure good work being done.

The machine is under perfect control; and electricity as a motive power in the retort-house has proved its superiority, and provided an elasticity of command in working to a very high degree. Level charges of coal in the retort are regularly obtained; it also being possible, of course, to have uneven layers of coal—either too thick or otherwise—should the operator be dilatory in attention. Repairs have been practically *nil;* and this is, undoubtedly, a promising and most satisfactory feature of an installation of the kind. It is worthy of particular note, as having an important bearing on costs of upkeep, that no part of the projector type of machine enters the hot retort. The distance from the point of projection of the coal from the belt to the retort mouthpiece is 3 ft. 6 in. The coal is carried across the intervening space to the retort without causing spilling, except odd pieces on occasions. As to the life of the belt—the only real part likely to require frequent renewal—the one in use at Alloa has passed about 8000 tons of coal and nuts, and from present appearance is likely to do double that quantity. The raised portion of the belt has become pretty well worn, and at parts is entirely gone. As the belt is revolving when in front of the furnaces, the heat does not have any deteriorating effect. It has to be stated that a slight increase in gas made per ton is now being obtained, as compared with hand-charging, though it is not claimed that the benefit in this direction has been very marked as yet.

Results as Compared with Hand Charging.

The following tabulated statements give the working costs. In setting out these tables of costs, it will be readily understood that absolute uniformity of comparison with other works is in great measure impossible, because of certain extra duties which may or may not be included; and therefore it has been thought better to state clearly the work done as represented by the figures given. While there is this difficulty in making comparisons with other works, as regards the practice at Alloa an exact comparable basis is possible between hand labour, as before, and coal handling and charging of retorts by machinery; the entire duties comprised under both systems being the same.

Hand Charging and Drawing with Eight Ovens of Eight Retorts Each.

24 stokers carbonize 2 tons 9 cwt. of coal each.
" " 58 " 16 " " per 24 hours.
" " 411 " 12 " " per week.
Rate of wages—4s. 9d. and 4s. 6d. per shift of eight hours.

Total wages paid per 24 hours	£5	10	3
" " week	38	11	9

$$\text{Cost per ton} = \frac{£38\ 11s.\ 9d.}{411\ \text{tons}\ 12\ \text{cwt.}} = 1s.\ 10{\cdot}5d.$$

The "D.B." Charging-Machine with Hand Drawing with Eight Ovens of Eight Retorts each and One Oven of Six Retorts.

15 stokers carbonize 4 tons 5 cwt. of coal each.
" " 64 " of coal per 24 hours.
" " 448 " " per week.
Rate of wages—4s. 9d. and 4s. 6d. per shift of eight hours.

Total wages paid per 24 hours	£3	9	9
" " week	24	8	3

$$\text{Cost per ton} = \frac{£24\ 8s.\ 3d.}{448\ \text{tons.}} = 1s.\ 1{\cdot}07d.$$

Saving effected = 9·43d. per ton.

Note.—The above costs represent the total charges applicable to the carbonizing and handling of coal from its delivery into the retort-house to the wheeling of the coke into the yard, clinkering of the furnaces, wheeling out of the ashes, general retort-house work, attention to boiler, and, in addition, looking after exhauster, carburettor, &c.

In order to complete the costs applicable to machine stoking, the following charges require to be added:—

	Pence per Ton.
Oil and sundries	0·27
Wages incidental to plant	0·37
Gas used by engine for generating current and driving breaker and elevator	0·94
Carbonizing wages	13·07
Total	14·65

Actual repairs to plant, after eight months' work, have been practically *nil*, and, while this item cannot yet be determined, one is perfectly justified in assuming that the cost per ton under this heading must be very small.

The initial cost of the whole plant—viz., gas-engine and dynamo, coal breaker, elevators, hoppers, projector, supplied and erected as a complete installation, and including the breaker pit and foundations—was £2062. In order to arrive at an absolute cost per ton of coal carbonized, and having regard to interest and depreciation, the following are the capital charges per ton of coal carbonized. To form this estimate, the total coal carbonized per annum—viz., 12,900 tons—is taken as a basis.

	Pence per Ton.
Interest on £2062 at 3½ per cent.	1·34
Depreciation of plant.	2·34
Total	3·68

Under depreciation of plant, the projector machine is depreciated at 10 per cent., and the gas-engine and dynamo, switchboard, cables, &c., at 7½ per cent.

It must be strictly borne in mind that the projector is capable of charging a much larger number of retorts than the maximum in use at Alloa. With the full number of retorts working, one man on the machine has charged close upon 200 retorts per shift of eight hours, besides closing lids and attending to the breaking and elevating of coal and other duties, the actual time of working being 3¾ hours. With one man doing charging only, it would be possible, with comfort, to do 170 to 200 retorts per hour.

The costs above stated are based on results obtained during the winter months, when the throughput of coal is greatest on the average. The author prefers to wait for a full year's working before determining the average cost per ton of coal carbonized; but it may be stated that for the six months ended the 31st of May last the saving in stokers' wages amounted to £230, or equal to about 8d. per ton of coal carbonized. It was somewhat unfortunate that the plant was started in the middle of winter, as for some short time, until everything got balanced to the new order of things, it was necessary to employ more men than if the plant had started earlier in the season. It is hoped, therefore, with a full year's working, that the results will turn out even better than those shown.

The kind of coal to be used and its choice require no particular consideration. As far as my experience goes, I am enabled to state that the De Brouwer projector is capable of suiting itself to all the general conditions of retort-house work for horizontals, and especially in the oldest houses, where the space available is small. In these times of commercial competition and aggressive work in improvement and invention, it must always be considered of advantage to keep down capital outlay, and modify the desire, too frequently practised, of clearing away the old to be replaced by the new.

The Pulsometer Engineering Company, Limited, of Reading, have recently opened offices at No. 206, Corn Exchange Buildings, Cathedral Street, Manchester, with Mr. George Thompson as Manager, and consequently Messrs. F. B. Welch's agency has terminated.

The cost of pumping water at Chicago is given as 2·28 c. per 1000 gallons in a report recently made to the Commissioner of Public Works by Mr. John Ericson, the City Engineer. The cost is further classified as follows: For water that produces revenue, 6·14c.; for water that produces revenue and water furnished free, 5·43c. As to the distribution, it appears that 15 per cent. is metered water paid for, 22 per cent. is unmetered water paid for, and 5 per cent. is furnished free, including that for the city's use and for fire purposes. This leaves 58 per cent. of the total quantity pumped classed as "unaccounted for."

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

ANNUAL MEETING AT SCARBOROUGH—JULY 12 to 14, 1906.

PAPER READ.

TROPICAL WATERS AND THEIR PURIFICATION.

By H. G. FOSTER-BARHAM, Assoc.M.Inst.C.E.,

Late Engineer to the Brisbane Board of Water-Works.

The matters dealt with in this paper and the conclusions arrived at are mainly the outcome of certain investigations carried out in Queensland, where the author acted as Engineer to the Brisbane Board of Water-Works. Though the conditions dealt with may not be exactly similar to those existing in other hot countries, it was nevertheless hoped that what was stated might be of some use to engineers having tropical supplies to deal with, and that the subject might be a fruitful one for discussion at the meeting of the Association.

After a long historical introduction concerning Brisbane and its water supply, and the condition of the water after storage in the various service and other reservoirs—this portion being accompanied by an elaborate series of ten tables of results of analyses—the author proceeded to describe certain experiments carried out with a view to the purification of the Enoggera and Brisbane River waters.

Experimental Purification.

Realizing the importance of the subject, the Water Board, on the author's advice, decided to carry out experiments on different methods of filtration, and for this purpose several experimental filters of different types were erected. Eventually, after innumerable delays, a laboratory was built, and a competent analyst employed to superintend the work. It was soon found that the reservoir water required no ordinary treatment; and the following processes were experimented upon:—

1. Continuous sand filtration.
2. Intermittent sand filtration.
3. Mechanical filtration.
4. The destruction of algæ by sulphate of copper.
5. Precipitation by iron.

Regarding these experiments it may be stated that the test for colour was carried out by means of a Lovibond tintometer; that the tests for "free" and "albuminoid" ammonia and "oxygen consumed by moist combustion" were determined by Wanklyn's method; and that the rate of filtration—unless otherwise mentioned—was about 2·1 million gallons per acre per 24 hours—corresponding to 2 gallons per square foot per hour.

Two kinds of sand were experimented with. One was obtained from the stream-bed below the Enoggera embankment, and was derived from the decomposed washings of a sort of bastard granite. It was not a sharp sand and reduced in size considerably during the course of the experiments. The other was a hard sharp sand obtained from the Brisbane River which proved to be of a much more durable quality. In every case, the sand was sifted and the "effective size"* determined in the laboratory.

Continuous Sand Filtration.

The experiments carried out under this heading were performed in galvanized iron tanks, 8 feet in diameter and 8 feet deep. Altogether, five different filters were experimented upon, differing only from one another as regards the nature, depth, and fineness of the filtering material used. For this paper, however, two only need be described, called respectively No. 1 and No. 2. No. 1 had an area of 25 square feet, and the following section of filtering material:—

Fine Enoggera sand at top of bed. ("effective size" 0·335 mm.)	41 inches.
Coarse sand	2 ,,
Gravel subdrains	10 ,,
Total depth of material	53 inches.

* The "effective size" may be defined as such that 10 per cent. of the material is of smaller grains, and 90 per cent. of larger grains than the size given. Each grain is assumed to be of equal volume to that of a sphere whose diameter is equal to the cube root of the product of the 3 main axes of the sand grain. In any assortment of sand, the finer 10 per cent. appears to have as much influence on the action of the material in filtration as the remaining 90 per cent., and the experiments at Brisbane fully confirmed the great importance of fineness and uniformity in the size of grain.

The depth of water over the sand was 41 inches, and the maximum loss of head 91 inches. The filter was charged with filtered water from below in the ordinary manner, and the unfiltered water was delivered above in the form of a fine spray for the purpose of thoroughly aërating the water. The length of run before choking occurred averaged 70 days. The average reduction of organic matter as determined by the albuminoid ammonia was 53 per cent.; and the reduction in colour was 66 per cent. of the yellow and 93 per cent. of the red units. The average reduction in the number of bacteria from 462 per cubic centimetre in the raw water, to 7 in the filtrate, amounted to 98·5 per cent.

Filter No. 2 had an area of 22 square feet, and the following section:—

Fine river sand at top of bed (effective size, 0·28 mm.)	12 inches
Fine crushed quartz sand	1½ ,,
Fine cinders	6 ,,
Medium cinders	5 ,,
Large cinders	5 ,,
Coarse sand	7 ,,
Gravel underdrains	19 ,,
Total depth of material	55½ inches

This filter was erected in order to determine the efficacy of cinders as a filtering medium. Although the results, judged from a chemical analysis, are slightly better than the last, this was proved to be due to the superior quality and finer grade of the surface sand used. The smaller reduction in the number of bacteria, which amounted to 92·6 per cent. as against 98·5 per cent., is accounted for by the sand-bed being less deep.

The short length of run between the necessary scraping of the sand surface, which averaged 31 days, was no doubt due to the finer grade of sand use. The reduction in colour was better than with No. 1 filter. No doubt slightly better results could have been obtained with a filter having, say, 3 feet of river sand of an effective size of 0·30 mm.

It was found that a very much larger proportion of the organic matter and colour could be removed by the filters in the warm than in the cold weather—due no doubt to the greater bacterial activity at such times. For a similar reason the amount of dissolved oxygen in the effluent water was found to be very low during the summer, and as, at such times, the raw reservoir water, drawn from a depth of 5 feet below the surface, contained only 75 per cent. out of a possible 98 per cent. of dissolved oxyen, it was decided to introduce the water on to the filters in the form of a fine spray. This had the effect of practically saturating the raw water with oxygen; but although this resulted in very slightly increasing the proportion in the effluent, it still became practically all exhausted in its passage through the filters.

It turned out upon further investigation that whereas the bacteria were practically all removed from the effluent in the top 6 inches of the sand, only about one-half of the total absorption of oxygen had taken place at such a depth, and that the amount continued to decrease at a fairly uniform rate throughout the remainder of the filtering material, where there were comparatively few bacteria present.

No doubt the removal of bacteria is mainly due to the straining action at the surface of the filter, whereas the oxidation of organic matter in the water still continues to take place during its passage through the lower portion of the bed.

That the oxidation is very incomplete in filters of this class is shown by the low proportion of nitrogen, as "nitrates," present in the effluent.

Intermittent Sand Filters.

In order to counteract this exhaustion of the dissolved oxygen in the effluent, a filter was designed on lines similar to those of the city filter at Lawrence, Mass., U.S.A. This filter, called No. 3, had an area of 76 square feet. The bed was composed of 5 feet of Enoggera sand of an effective size of 0·27 mm. placed over 12 inches of sand and gravel surrounding brick subdrains.

When in use, water was allowed to flow on to the sand from a gutter placed across the centre of the filter, and 2 inches above its surface. No attempt was made to cover the sand with water, and as the surface was fairly dry no "schmutzdecke" or surface slime formed, such as occurs

with ordinary continuous sand filtration. The intervals between scraping were consequently very much increased.

Two daily periods of rest were tried, each for a considerable time, for the purpose of aërating the beds—namely, 4 hours and 8 hours. The latter gave the best results. The rate of filtration had to be increased during the 16 working hours in order to produce the same amount of filtrate as in the other filters experimented upon; but in spite of this, the results obtained by this filter were excellent in all respects save the reduction of bacteria, which only averaged about 74 per cent. This is no doubt accounted for by the absence of the "schmutzdecke" on the sand surface.

The amount of dissolved oxygen in the effluent of this filter was found to be 70 per cent., as against 10 per cent. in filters Nos. 1 and 2. The nitrogen as "nitrates" was also considerably higher; showing that the reduction of the organic nitrogen was more complete. At the Lawrence experimental station, the results showed that with intermittent sand filters the beds of which are not less than 4 feet thick, and the rate of filtration from 1·6 to 5·5 million gallons (English) per acre per day, the reduction in the number of bacteria amounts to 99·32 per cent. This is a very much higher efficiency than was ever obtained at Brisbane with this type of filter.

The analogy of filter No. 3 to the "Ducat" and "Stoddart" beds used in sewage purification led to the development of a type of filter which, as far as the author is aware, has never been before applied to water purification. The idea was due to a Mr. Arthur Morry who was in the employ of the Queensland Government Public Works Department, and who at the time was erecting some small sceptic tanks and oxidizing beds for sewerage disposal.

Filters No. 4 and No. 5, typical of six others experimented upon, may be described as biological oxidizing beds, and were worked either above or in conjunction with an ordinary sand filter of No. 1 type. Briefly, these filters were composed of about 6 feet in depth of sand gravel or coal in varying grades. The sides were open in some cases for purposes of aëration. The raw water was delivered on to the filters through an automatic intermitter of the syphon type, from which it was led into the receiver of a horizontal revolving sprinkler mounted on ball-bearings which distributed the water at regular intervals uniformly upon the surface of the filter, through which it percolated by means of under drains into a receiving basin at the bottom. This method of distribution, which is successfully used in this country in bacteria beds for the treatment of sewage, ensures, even in the warmest weather, an aëration of about 86 per cent. of saturation of dissolved oxygen in the water as it is delivered on to the surface of the filters. It was found, moreover, that the open form of these filters increased this proportion of dissolved oxygen to over 95 per cent. in the effluent.

The eight filters of this type experimented upon may be roughly divided into two classes: (*a*) Those in which sand formed part of the filtering material. (*b*) Those in which gravel only was used.

Two were of the former class. In both these the top of the bed was composed of 12 inches of sand with an effective size of 0·33 mm. In the remaining 5 feet of filtering material one filter had four layers of gravel of different grades, varying from $\frac{1}{16}$th inch siftings at the top to $\frac{1}{2}$ inch siftings at the bottom, and in the other the gravel was replaced by 5 feet of coal, similarly arranged and graded.

The coal filter was so constructed as to secure both bottom and side aëration. This was done by laying six vertical 4-inch pipes round the inner circumference of the filters at intervals of 2 feet, and thus connecting the bottom receiver to a point 3 inches above the surface of the sand. No such provision for aëration was made in the gravel filter, with the result that its effluent contained 33 per cent. less dissolved oxygen.

Of these two filters, the one containing gravel (No. 4) gave decidedly the best results as regards reduction of colour and organic matter. The bacterial reduction of 92 per cent. was the same in both, and the proportion of dissolved oxygen in No. 4, equal to 61 per cent., would no doubt have been increased to over 90 per cent., had the same means been provided for aëration as was employed in the case of the coal filter.

These two experiments proved the efficiency of such a method of aëration, and also that no special advantage was to be looked for from the use of coal as a filtering medium.

In the case of both filters of class (*a*) some trouble was experienced owing to the choking of the sand surface. This was particularly noticeable at the period of "circulation" in the reservoir, at which time it was necessary occasionally to rake over the surface of the sand two or three times weekly. Such raking was, however, quite the exception, and little trouble was as a rule experienced on this account during the eight months in which these filters were working. It is possible, however, that the whole of the sand would require occasionally to be removed and washed.

Filters of class (*b*), in which gravel only was used, took some time to properly mature; but no trouble was experienced as regards choking. One of these filters worked continuously for three years without any cleaning being required. Generally it may be stated that although in filters of this type the nitrification and aëration of the effluent is excellent, there is nevertheless a slight tendency to allow suspended matter to pass through them, and moreover the bacterial reduction was in no case what it should be.

A consideration of these defects led to a combination of an upper gravel filter of the class (*b*) type, worked in conjunction with a lower filter of the ordinary No. 1 sand type. This combination (filter No. 5) was constructed as follows: The upper filter had an effective area of 12 square feet. No pipes were built in the filter for aërating purposes, but the sides were composed of open rubble stonework, and enclosed a depth of 3 feet of Enoggera sand of a size such that it had passed through a 3-16th inch sieve and had been retained on one of 1-16th inch mesh. The feed was delivered through a sprinkler, similar to the one described for No. 4 filter. The lower filter had an area of 18 square feet, and was composed of the following materials:

	Inches.
Enoggera sand at top (effective size, 0·28 mm.)	24
Coarse sand	2
Gravel and underdrains	10
Total depth of material	36

The effluent from the upper filter was led in the form of a fine spray on to the lower one. The depth of water on the lower filter was 11 inches, and the intervals between the cleaning of the surface averaged 32·8 days. Filtration was carried on over the combined areas of the upper and lower filters at the same rate as in the case of filters Nos. 1 to 4, and the results compared very favourably with that obtained from any other of them, both as regards the reduction in organic matter, colour, and in the number of bacteria.

The proportion of dissolved oxygen in the effluent was about 66 per cent.; but this figure, though not equal to that obtained in filters of No. 4 type, compares with 10 per cent. obtained with sand filters Nos. 1 and 2, whereas the reduction of 97·3 per cent. in the number of bacteria is almost equal to the best obtained with these filters.

The total loss of head with the combination in No. 5 amounted to 7 feet, and it is claimed that it includes all the advantages of the other types so far dealt with, without their disadvantages.

Mechanical Filtration.

This is essentially an American process of purifying water, and is being largely employed in the United States. The method of procedure is well known, and consists primarily of precipitation, usually in settling tanks, followed by rapid sand filtration.

The precipitation is almost invariably hastened by the addition of some coagulant such as sulphate of alumina, lime, or ferrous or copper sulphate. Of these, only the first two were experimented upon at Brisbane. The process is only "mechanical" in so far as concerns the cleaning of the filtering material, which is performed by a reversal of the water current, while at the same time either air is blown in from below, to help in stirring up the sand, or the same effect is produced by revolving rakes.

Both methods were tried at Brisbane, and of the two the author found that an air blast, induced by a steam blower, gave the better results, and was very much simpler than the employment of rakes, the use of which involve considerable complications.

After detailing the results of numerous experiments carried out with different doses of sulphate of alumina and lime, both together and separately, in order to determine the proportions that gave the best results in precipitating the

impurities in the Enoggera and Brisbane River supplies, the author proceeded to refer to

Machine Filters.

Two different machine filters were experimented upon, but for the purpose of this paper only one need be described. This was formed out of a vertical cast-iron open-topped cylinder, 20 inches in diameter and 10 feet high, provided with stirrers, for agitating the sand during the process of washing. The receiver at the bottom had a perforated roof, upon which rested the filtering material, composed of 18 inches of gravel of a size varying from ½ inch diameter at the bottom to ⅛ inch at the top. Over this again rested 3 feet of fine river sand, all of which had passed through a sieve having 16 meshes per lineal inch, and which had been retained on one having 30 meshes to the inch.

The overflow from the precipitation tank, above referred to, passed on to the top of this filter, through which it flowed at a rate corresponding to 104 million gallons per acre per 24 hours, or almost exactly fifty times the speed adopted in the case of the filters already dealt with. The filtrate passed through a swing arm fixed at the bottom of the cylinder, by means of which the head could be gradually increased up to a maximum of 6 feet as the filter choked.

The percentage of washwater required for cleaning purposes was about 5 per cent. of the water filtered. Although 4·5 grains of lime were added per gallon of water treated, only 1·74 extra grains were left in the filtrate, the other 2·76 grains added having been precipitated with the alumina. The slight increase in "free ammonia" is due to the fact that the alum employed at the time contained some sulphate of ammonia. The hardness was slightly increased, but not to any deleterious extent. The reduction in organic matter as determined by the "albuminoid ammonia" and "oxygen consumed" tests—which amounted to 72 and 50 per cent. respectively—was greater than that obtained in any of the other experimental filters already dealt with. This analysis, however, represents about the best results obtained. The average results taken over a period of three months with this type of filter showed that these are hardly up to the tests obtained by some of the other processes.

It is, however, a matter of some regret that the general arrangements were incomplete at the time the mechanical filtration tests were carried out—especially as regards bacterial analysis. Moreover the mechanical filtration experiments were conducted at Brisbane before proper laboratory accommodation had been provided, whereas all the other tests were carried out at Enoggera Reservoir, 7 miles distant. The results are thus not altogether comparable. Had the Water Board provided the same facilities in the case of the mechanical filtration as were supplied in the other later experiments, still better results would no doubt have been obtained. As a matter of fact the staff was undermanned throughout all these investigations, and the results obtained are consequently less complete than they would otherwise have been.

Under these circumstances, the author has considered it may add to the value of this paper to include the final and official results of certain experiments which were carried out at Cincinnati, U.S.A., in 1898-9 for purifying the waters of the Ohio. The arrangements at Cincinnati were much the same as those adopted in the mechanical filtration experiments at Brisbane; but the American experiments were carried out in a far more exhaustive manner than was possible at the time at Brisbane. The removal of organic matter, bacteria, and suspended matter at Cincinnati, as also a comparison of the reduction effected by the settling-tank and the filters, showed that the American results were a considerable improvement on anything obtained at Brisbane.

This was no doubt mainly due to the longer period of subsidence, but also in part to the slower rates of filtration and the very much finer sand used. The average reduction in the number of bacteria was 99 per cent., but the official report says that in ordinary working it ought to be possible to obtain as high a reduction as 99·8 per cent., as the average results included several days of low reduction which in ordinary working would have been avoided. The purification effected by the settling-tank in these experiments was especially remarkable. The Ohio water, it may be remarked, has many characteristics common to that of the Brisbane River.

Other Processes of Purification.

The author left himself little time for describing two other investigations which were carried out with a view to purifying the Enoggera supply. The first of these was by the use of iron as employed in the Anderson process of water purification. The second was the employment of sulphate of copper for the destruction of algæ in the reservoir water.

Purification by Iron.

Unfortunately these investigations were limited to laboratory treatment, but the results were so encouraging that the Water Board has decided to erect proper experimental plant on the Anderson principle. The process consists primarily in bringing raw water into intimate contact with iron particles, and is followed by aëration, settlement, and filtration. In this process the iron particles are dissolved in the form of a ferrous salt of iron. This is then oxidized by aëration, resulting in the formation of insoluble ferric oxide and carbonic acid. The ferric oxide acts first as an oxidizing agent to any organic matter in solution, and, when allowed to settle, as a precipitant, precisely as does alumina.

The results obtained in the laboratory, after 48 hours' settlement and filtration through two thicknesses of filter-paper, were better than those obtained by any other process for treating the Enoggera water, except perhaps the mechanical process.

The results were not in all respects comparable, but they showed the Anderson process to be particularly applicable in the treatment of these waters.

In this connection, the results obtained by Messrs. Chadwick and Blount* in their treatment of highly organically contaminated waters in Uganda and Mauritius are particularly interesting. These gentlemen employed the Anderson process very successfully in cases much the same as that of Enoggera, but found that the worst waters required supplementary treatment by a second precipitation with lime and alum prior to final rapid machine filtration. It is interesting to compare the analysis of the raw water of this river, which they speak of as being one of the worst with which they have had to deal, with that of the Enoggera reservoir, which is half as rich again in organic matter. The percentage reduction of organic matter obtained in the case of the Nairobi River water was particularly good.

The last process experimented upon is one due originally, so the author believes, to Dr. G. F. Moore. The well-known toxical properties of sulphate of copper upon algæ induced Dr. Moore to try the effect of dosing a reservoir with this salt, and this is now being frequently done in America with considerable success. A period of stagnation is chosen when the organisms are mostly at the surface. The usual method of application is to tie bags of copper sulphate from a beam, suspended across the stern of a launch, which then patrols the reservoir, the salt gradually dissolving in the water. Recent experiments carried out in this way by the Denver Union Water Company, upon their Marstow Lake † showed that five days after treatment practically no micro-organisms could be found in the surface water, although a large number and varied assortment had before been present. The bacteria, on the other hand, had increased from 700 to 107,500 per cubic centimetre, as a result of the increased food supply due to the dead algæ. Tests made for copper sulphate four days after its application to the reservoir failed to detect any, it having all been deposited in the meantime.

At Brisbane the experiments were only carried out in the laboratory, it being impossible to throw Enoggera reservoir out of use at the time. The results fully confirmed those previously obtained elsewhere as to the destructive power this salt exercises upon algæ; it being found that even as small a dose as one part of copper sulphate in from 8 to 10 million parts of water had the effect of removing the most obnoxious algæ from the reservoir water. Three days proved enough for this purpose; and although tests were applied to the decanted water sensitive enough to have detected one part of copper sulphate in 25 million parts of water, none could be discovered at the end of this period.

The toxical effects of the salt were found, however, to vary with the quantity and nature of the organisms present in the water; it being shown for instance that the algæ were

* See Minutes of the Institution of Civil Engineers, Vol. CLVI.

† See "Engineering Record," Nov. 25, 1905.

less sensitive to the poison in the presence of other organisms such as spirogyra.

It was proved also that although by the removal of the bulk of the algæ a remedy was found for the bad smelling qualities of the water, nevertheless as the salt had no apparent effect upon either the dissolved organic nitrogen, or the colouring matter present in the water, its application could not in any way be regarded as a substitute for filtration. This bears out what might be expected, since it can be shown that approximately only 1-25th part of the nitrogen contained in a water can be accounted for by the presence of algæ in the assumption that the portion represented as albuminoid ammonia is derived entirely from such algæ.

The author is informed that the President-Elect has carried out an experiment with sulphate of copper with very satisfactory results, and would suggest the desirability of further practical investigation of this very interesting process.

Conclusions.

A stage has now been reached when it is necessary to draw in the threads of evidence and see what can be made of them.

Unfortunately, the conclusions arrived at are very much less complete than they might have been, had the Water Board realized sooner the exhaustive manner in which it was necessary to conduct these experiments. Nevertheless, much has been learnt; and the author will make a short summary of the conclusions at which he has arrived.

In the first place it must be admitted that, large as has been the percentage of reduction in the organic matter in many of the methods experimented with, still, as regards chemical analysis, the filtered water leaves much to be desired when compared with the standards of purity to which we are accustomed in this country, and which, as has been shown, can be obtained elsewhere.

Nevertheless, it must not be forgotten that such standards are purely arbitrary, and that the impurities remaining in the treated Enoggera water may not be, and probably are not, in any way harmful when taken into the human system. The filtrate was in most cases a bright sparkling water, pleasant to taste, odourless, and sufficiently pure to remain sweet when kept indefinitely in sealed bottles. A larger percentage reduction in organic matter could doubtless be obtained by second treatment, or, better still, by combining one method with another.

Dr. Moore's process may be dismissed very shortly. The treatment judicially carried out undoubtedly does good by removing obnoxious algæ from a reservoir, but could the *débris*, which now enters the reservoir with every flood, be kept out, the improvement in this respect would be even more marked.

In any case such treatment would have to be supplemented by filtration, since, as has already been shown, the introduction of sulphate of copper into a reservoir produces no material effect upon either the colouring matter, or the amount of dissolved organic matter present in the water.

The experiments show that this well-tried process maintained its superiority as regards reduction in the percentage of bacteria over all other methods. Its failure to produce a greater reduction in organic matter is due to the oxygen having become exhausted before nitrification was completed.

Excellent results might be expected from intermittent filtration, even on a large scale, with either of the methods Nos. 3 or 5. In the case of No. 3 a better bacterial efficiency could no doubt have been obtained by following more closely the lines adopted at Lawrence. The No. 5 combination is particularly encouraging; and the author's only regret is that the experiments were not carried a little further, in order to ascertain the effects produced by settlement with coagulants at the different stages of the process. All the experiments with Enoggera water proved the difficulty of reducing the organic matter below certain limits, but the reduction obtained by a preliminary treatment with either alum and lime, or with iron, is so marked that the author is led to the conclusion that the best results will not be obtained without their assistance.

Though aware that oxidizing beds depend for their efficiency upon their biological activity, he would be more inclined to carry out preliminary purification by coagulation and settlement, leaving the final reduction and oxidation to these beds. Should this precipitated water prove insufficiently rich in organic matter to maintain an active crop of nitrifying agents, the remedy would always be at hand, either by reducing the amount of coagulants or in temporarily stimulating the beds by allowing untreated water to pass over them.

As regards the treatment of the Brisbane River supply the author has no doubt that owing to local conditions and the varying nature of the water, no process will be found more satisfactory than that of precipitation with lime and alum followed by rapid sand filtration.

These conclusions are very much strengthened owing to the adoption of this process in similar cases in America, Egypt, and elsewhere. In these countries the most exhaustive experiments were carried out with this and other methods of treatment before its final selection.

In the case of the Enoggera supply the author is inclined to the view that the best solution will be found in a preliminary treatment with iron, as in the Anderson process, followed by the most thorough aëration and precipitation. Whether a second precipitation with lime and alum, as was adopted in Uganda, would then be necessary, would depend upon the degree of purification aimed at; but the precipitated water would certainly require a final filtration and aëration.

What particular filter would give the best result would be a matter for experiment. Probably any of the types here dealt with would answer more or less effectively, and the final choice would depend on local conditions governing the arrangements of supply.

Mr. Percy Griffith, before reading the paper, explained that Mr. Foster-Barham's absence was due to the fact that he, after being in this country for some few months, had been appointed to take charge of an important water undertaking in Korea. This prevented Mr. Barham attending the meeting as he intended to do. The experiments recorded in the paper were carried out by the Municipality of Brisbane, and represented a cost of several thousands of pounds. He thought the members would appreciate more the information the paper contained when they knew the cost it represented.

Discussion.

The President said the paper was to his mind a very good example of an engineer doing important work, and keeping a very careful record of the experiments entered into. A small experiment of his (the President's) was mentioned. That was the sulphate of copper experiment for cleansing a reservoir; but what was done was in a very small way—just as a test. He acted on the basis of 1 in 8 millions. That was a very small quantity; and it meant 1 lb. of copper sulphate in 800,000 gallons of water. He used about 200,000 gallons in the treatment of the Osgodby reservoir. The accumulation of the growth in the bottom of the reservoir was a kind of matted substance, which was very difficult to remove, even by scraping with chisels. The reservoir was treated with the sulphate of copper last October; and on emptying it three weeks ago, they found none of the accumulation on the bottom. Something had altered the state of affairs; and this he put down to the treatment by the sulphate of copper. They did not mix the sulphate of copper with the water, and then send it out to the consumers; they simply cleansed the reservoir with the solution. He had treated the reservoir in the same manner again, and should see what the summer months would do in comparison with the winter. Another point which also interested him was the iron treatment, in combination with lime. Some time ago, he went into the matter with the view of softening the Scarborough water; but the Corporation concluded they had better leave well alone. If they adopted an "Anderson" revolving cylinder, and passed the water through that with a small quantity of iron, and then put the water through the lime treatment, the precipitation was obtained in much reduced time. This might be useful in some cases; but on the occasion referred to they went no farther.

Mr. Easton Devonshire (London) said that there were several points in this paper of very great interest to him, especially as the previous week he had the opportunity of seeing in Paris for the first time one of what are called the Puech filters, or gravel strainers. Mr. Barham seemed to conclude that the combination of treatment with iron and straining through gravel, was likely to give the best results in the case of the Enoggera water, with or without the use of alum, lime, or other coagulants. What he (Mr. Devonshire) saw in Paris with Dr. Kemna was so exceedingly

interesting and novel that he thought it would be worth while the members of the Association seeing it for themselves. He saw these Puech filters at Suresnes, purifying about 10 million gallons of water a day. There was a series of these gravel strainers—a series of four, in gradient. The first filter had a comparatively small area, and contained very coarse gravel. The gravel became a little finer, and the area a little larger in successive filters. When he told the members the speed was fifty times that of ordinary sand filtration, they would understand that the size of the filters would be very small. Taking the water from the Seine, as it flowed on to the first filter, it seemed to be a fairly clear water. Then afterwards, looking at the result on flushing out one of the gravel strainers, it was perfectly astonishing what there had been in the water. After running the strainers for a few days, the gravel was turned over by shovels, and water was run through, with the result that an enormous quantity of mud was removed. The effect of this was, especially as the series of gravel strainers terminated in a pre-filter containing sand, to give the final sand filter very much less to do. The inventors of this scheme gave the sand filter so little to do in the final operation that at Suresnes, the sand filters had been running for seven months with a loss of only 6 inches of head. He noticed that there was a growth in the Suresnes filters which did not correspond with anything he had seen before on a sand filter. This growth was composed of a sort of floating island of a spongy nature; and comparing, in the tubes, the finished water with that in the half stage, he personally thought the finished water was not quite so bright as the half treated water. After it had gone through the pre-filter, it was very brilliant indeed; but after it had been treated in the last filter, it seemed to have lost a bit. It might, of course, be that the tubes were not quite straight, and that it was a question of refraction. But as corroborating his own view, Dr. Kemna's microscopical examination showed that the vegetable matter in the water had decayed; the result being that the chemical quality of the finished water was not so good as that half treated. This appeared to illustrate what the author of the paper was driving at—the combination of two things, the straining through gravel, and the subsequent slow filtration, as likely to give the best results. But this must not be overdone. There was one thing in the paper he wanted to criticize. As one who had been interested all his life nearly in sand filtration, he could not admit the unit of measurement which Mr. Foster-Barham gave, as representing the flow of filters. He talked of an acre of filter, and millions gallons per acre. It certainly did not satisfy him (Mr. Devonshire) to know that in a day so many million gallons of water could be got over an acre of filter. What they wanted were the gallons per square foot per hour, or, better still for the purposes of comparison, in inches or centimetres, the vertical height of a column of water passing through in a given time—say, in an hour. Then they had also to assume that, while the rate was so many million gallons per acre per day, the maximum permissible flow for the smaller unit of a square foot per hour was not exceeded. That was his only criticism. Probably he had made more experiments with the iron process than anyone in the room. The last time he went to Scarborough, it was with the view of putting the iron process before someone there, with the idea of its adoption. That was some seventeen or eighteen years ago; and he had since had to try the iron process, making experiments on a small or a large scale on such waters as those of the Schuykill River at Philadelphia, the Missouri at St. Louis, the Mississippi at New Orleans, the St. James River at Norfolk, Virginia, and Lake Michigan water at Chicago. In those days, he did not fully appreciate, the absolute necessity of the presence of carbonic acid in the water to get a thoroughly satisfactory result with the iron treatment. If they sent water through the Anderson purifier, it would not give a good result in the absence of carbonic acid. A simple way of compensating for the loss of carbonic acid was by the introduction of air into the purifiers. He would undertake to say they could scarcely find any water which they could not precipitate and clarify in a laboratory in this way: Take a bottle, and put in a handful of nails, fill the bottle half full of water, and shake it for three minutes. In 99 cases out of 100, they would find a precipitate falling in a very short time. When they introduced the Anderson process at Antwerp, they did not have the air introduced—in fact, they had not thought of it; and the purifiers were put at a level that made it impossible to pass air into them. But in Paris, for the Seine water, they foresaw the difficulty, when adapting the Anderson process at the works of the Compagnie Generale des Eaux at Choisy, Neuilly, and Nogent. At the Choisy works, which he visited again a week previously, they now had fifteen Anderson purifiers, which purified 22 million gallons of water per day regularly. At all three works, air was pumped through the purifiers during their rotation. The results had been uniformly good throughout, and the only improvement contemplated by the Engineer of the Compagnie Generale des Eaux was that gravel strainers should be introduced between the purifiers and the sand filters. This he (Mr. Devonshire) believed would be an advantage, as the work of the sand filters in removing the iron precipitate would be considerably lessened by the retention of the heavier portion of this precipitate in the gravel strainers. He had some remarks on the subject of the paper that had been sent to him by Dr. Kemna, whom the members would recognize as being one of the greatest authorities on sand filtration.

Mr. Devonshire then read extracts from Dr. Kemna's communication, which will be published *in extenso* in the "Transactions."

Mr. C. H. Priestley (Cardiff) said it appeared to him that the paper did not lend itself to any casual observations; and it was a paper such as they had seldom had before in this Association. The amount of detail that Mr. Foster-Barham had given them required deep study. He (Mr. Priestley) did not propose to enter into any examination of the paper; but he would take only one point upon which there was some difference of opinion. The author said his opinion was "that small drainage areas yielded the best results if cleared of forest." He did not know whether Mr. Foster-Barham meant this to be applied to tropical countries only. But in this country it had been said that they ought to grow timber on their drainage areas; and it was generally supposed to increase the efficiency of the drainage areas if they had timber there. This might be an open question; but he should like to hear other views upon it. His own opinion was that it was a good thing to have timber on a drainage area. Where the water flowed off too quickly, it could not be gathered, but flowed away to the river. If, however, they had timber on the drainage area, it helped to keep the water from flowing away. They then got the water at a time when the rainfall might be sparse; and timber was therefore most useful on the gathering-ground. He should like to ask the President if he rightly understood him to say that, after treatment of the Osgodby reservoir by sulphate of copper, the water was not used. At Newport (Mon.) the treatment had taken place during the last two years. An experiment on a small scale was made by the Engineer and the Medical Officer; and it was found to be efficient. Last year, the two older reservoirs—not the new one—which were in a bad state nearly every summer had been treated by sulphate of copper, with very good results, and the water had been supplied to the town after treatment.

The President, referring to Mr. Priestley's remarks, said the water in his own case was not sent out for consumption after treatment with sulphate of copper. They only treated the slopes and bottom of the reservoir with it thoroughly, and so cleansed it. Probably the Newport reservoirs were gravitation ones—not service reservoirs.

Mr. Priestley: Yes, at Newport.

The President remarked that that was quite a different state of affairs. The water in his own case was perfectly bright and clear; but either the action of the sun or of the atmosphere would turn the water in a very few days perfectly green. He thought it was the decomposition of the carbonic acid, and then algæ began to grow and increase. Latterly, they had had great trouble from diatoms. The water would become quite opaque, and day by day they could see it become more opaque and green in tint. Through a microscope, they could see the diatoms daily increased in quantity; and this it was that caused to a large extent the opacity of the water.

Mr. A. J. Jenkins (Jersey) said he appreciated the paper, both by reason of its intrinsic value, and also because of its example to the members of what they ought to do to investigate a complicated question like this. In the first place, he would like to point to this: After describing the continuous sand filters, Mr. Barham said, "The depth of water over the sand was 41 inches, and the maximum loss of head 91 inches." He (Mr. Jenkins) had been very much struck by the figure

of 91 inches. It was quite the largest he had heard mentioned; and it exceeded by more than 100 per cent. the standard required by Mr. Gill in the excellent paper, on the "Berlin Water Supply," that he read before the Institution of Civil Engineers ten or twelve years ago. The standard advocated by Mr. Gill was less than half this figure. He (Mr. Jenkins) thought it was 32 inches as the maximum allowable; and he pointed out that even with the depth of sand of 2 feet or more, there was a danger of breaking the crust of the sand, if the maximum were exceeded, so that the water would pour through in an irregular manner. A little later, in the paper by Mr. Barham, there seemed to be some slight inconsistency. He said: "The smaller reduction in the number of bacteria, which amounted to 92·6, as against 98·5 per cent., is accounted for by the sand-bed being less deep." That was a fair inference; but he saw further on in the paper that the author made this remark: "The rate of filtration had to be increased during the sixteen working hours in order to produce the same amount of filtrate as in the other filters experimented upon; but, in spite of this, the results obtained by the filter were excellent in all respects save the reduction of bacteria which only averaged about 74 per cent." Referring above, he saw that the depth of the sand in this case was 5 feet. He thought it needed a little further explanation, because it suggested to him that the less efficient bacterial reduction was possibly due to the increased rate of filtration, rather than to any other cause. Reference was also made to raking over the surface of the sand two or three times weekly. At Jersey, some little time ago, he had a curious experience. Not having too much water to spare, they endeavoured to wash the sand in the early part of the year, so that they should not have washing to do during the dry months. The last washing for the summer took place about the middle or end of May. Two years ago, he found the filters practically blocked after three weeks. He tried the experiment of simply raking the surface, instead of removing the sand for washing. He recommenced working the filters after some thirty-six hours; and he found their bacterial efficiency was not at all impaired. Furthermore they did not block up again for between three and four months. The conditions were exactly the same so far as the water was concerned; but the clean sand blocked up in three weeks. With reference to Mr. Devonshire's remarks, the only criticism that gentleman had had to make on Mr. Barham's paper was that he had given a standard of so many million gallons per acre. Perhaps Mr. Devonshire did not notice that Mr. Barham, in one part of his paper, said: "The rate of filtration (unless otherwise mentioned) was about 2·1 million gallons per acre per 24 hours, corresponding to 2 gallons per square foot per hour." That was, of course, about 4 inches per hour, which was generally regarded as a safe rate of filtration. In his own experiments, he had had the results watched by bacteriologists; and he had come to the conclusion that $3\frac{1}{2}$ inches per hour was slow enough to work any filter under European conditions, and nothing could be gained by decreasing the rate of flow below that. In his own case, they got the best results at some $3\frac{1}{2}$ inches per hour.

Mr. C. Clemesha Smith (Wakefield) said he thought the Brisbane Corporation had set an example to many municipalities in the direction of carrying out experiments before constructing new works. He was convinced that a great deal of capital expenditure might be saved, and works be more efficiently carried out, if experiments were put in hand before the work was done. With regard to the construction of settling-ponds for the water to pass through before it entered the storage reservoirs, in a scheme in which he was concerned (which was a moorland scheme, with storage reservoirs into which the water was gathered by means of long catchwaters), they had numerous small trenches through which the water passed into similar settling-ponds, which allowed the *débris* to settle out. They found this a very useful system of keeping the water clear and free from peat. They had in this manner taken out several thousands of yards of peat and sand which would otherwise have entered the reservoir in the course of the year. Mr. Priestley had remarked upon the question of cutting down timber. It was curious to find the author recommending that this should be done, when several corporations were now planting their gathering-grounds—Liverpool, Halifax, and others—to prevent floods and equalize the flow of streams. Possibly in some twenty or thirty years, some of these authorities might give them data as to whether their conditions were better after the planting than they were at the present time. With reference to stripping the site of reservoirs, Mr. Barham said it was advisable for the site of a reservoir to be stripped. That was a somewhat large operation; and he doubted whether it could be permanently successful. If they simply stripped the vegetation, when the reservoirs were drawn down, vegetation started again; and if they stripped the soil off altogether, and pitched or shingled the bottoms and slopes of the reservoirs with stone, they entailed a tremendous initial expenditure that would not be of permanent value, because the soil would be gradually deposited again, and they would have the same trouble recurring. With reference to filtration, Mr. Barham had made a very valuable series of experiments. He noted that the author said the experiments with mechanical filters were not carried out in such a manner as to be comparable with those of the ordinary sand and intermittent sand filter-beds. This was to be regretted, because it was a comparison that would have been very useful. He (Mr. Smith) gathered from the paper that the scheme to be carried out had not been finally decided upon. Perhaps at some future time they might have some details of the scheme, and particulars as to how it had worked. He should like to suggest that it was possible that a process of double filtration combined with sedimentation, with or without coagulants, might prove efficient in the case in question. Mechanical filters might be used for the primary filtration. They were open to some objections, which, however, could be got over. He suggested for secondary filtration the ordinary sand filter, with a layer of polarite, carbide of iron, or other magnetic iron oxide (the latter to assist in the oxidation of the organic matter). He happened to be connected with a concern that forty years or so ago filtered their water with carbide of iron; and some few particulars might be of use. This was in the West Riding of Yorkshire. The water was taken from a river into which the sewage from a number of towns with several hundred thousands of inhabitants was discharged. The water was first filtered through ordinary sand filters, then it had a second filtration through another sand filter, passing finally through Spence's carbide of iron. The filtrate was perfectly clear. He had not the chemical analysis; but evidence was given at the time of the last cholera epidemic that there was but a single case in the town, and that an imported one. Cholera was very bad in the towns above; so that, had the system of filtration not been efficient in removing the germs, there would have been a heavy death-rate. It should be added that, owing to increasing pollution, this source of supply was abandoned nearly 20 years ago. In regard to intermittent filtration, it seemed to him that one fatal bar to the use of that was the great increase in the temperature of the water. Some time ago, they installed at Wakefield the ordinary sand filtration system; and they had complaints from certain manufacturers that the water was not of such great value to them as formerly, because there was a slight rise in temperature. Now if intermittent filtration, in which the water was sprayed through the air, was used, it seemed to him the rise of temperature must have been considerably greater. Mr. Jenkins referred to the filtration head. In the paper, 91 inches was given as the maximum head. He himself worked with a maximum head of something like one-third to one-half of that. The crust was not broken even with 5 feet; but from 3 feet to 3 ft. 6 in. the increase of head was extremely rapid. So that it did not tend to efficient working to go beyond 3 ft. 6 in. or 4 feet under their conditions. On the question of raking, he asked whether Mr. Jenkins had tried combining raking with scraping, because, if so, it seemed to him, from Mr. Jenkins' remarks, that by such a course the latter would materially reduce the cost of working his filters.

Mr. Jenkins said the result of raking was that he had to wash more sand on the next occasion; but he had to do it when they had an abundance of water for it, and he had a great saving in that respect.

Mr. C. L. Simpson (London) said that it would be very interesting to know, when filtering water by mechanical means, how far the size of the storage reservoirs could be reduced, and would the sand filters be capable of dealing with a larger capacity when fed with water which had first passed through mechanical filters. The problem that large water-works had to consider when extension became necessary—and this was the cause especially with those works which obtained their supply from rivers—was the increased capacity of the storage reservoirs required, also the increased size of the filter-beds, all of which entailed considerable capital expenditure. As this question of mechanical filtration

had been very largely studied both in this country as also in America, as well as to some extent in Egypt, and was now being introduced to India, it would be very interesting to know how far storage reservoirs could be reduced, and as to the advantages that were obtained by using mechanical filters in comparison with existing sand filters.

Mr. W. H. Humphreys (York) said, with reference to Mr. Simpson's question, it was, as he understood it, to what extent would storage reservoirs be reduced by introducing mechanical filtration. His own opinion was that, where they could take the water from a river, and they were not obliged by Act of Parliament to provide certain storage (as at the Staines reservoirs and one or two other places on the Thames), the storage reservoirs, if there was efficient mechanical filtration, were absolutely unnecessary. He could prove that point by this: When they took up the question of mechanical filtration seven years ago, it was then a question of building a very large storage reservoir, or doing something by which they could safely do without it. After a great deal of investigation, they decided, instead of constructing a storage reservoir, to put in mechanical filters. The filters adopted were the American Sewell filters. They put down four of these, of a capacity of 750,000 gallons each. The result was so satisfactory they put down three more of the same capacity. At the present time, they had mechanical filtration equal to 5¼ million gallons per day. The result was that they found it absolutely unnecessary to have a storage reservoir. He would suggest to members who were considering the question of building storage reservoirs to try mechanical filtration, unless, of course, the reservoir was used solely for storage. Mechanical filtration would do more than any settlement in a reservoir. The question of enlarging sand filters had also been gone into. He found that there was no necessity for enlarging sand filters if they had mechanical filtration. Quite the contrary. His experience was that mechanical filters, both bacterially and chemically (this was the result of a great amount of investigation), if working at a proper rate, would, within the maximum quantity, give a purification equal to about 90 per cent. That, in their case, was only leaving them (say) 9 per cent. further to do in the large sand filters. And this was done quite easily. It was a very remarkable result. Some day, when he had time, he might put these figures before the members, because he thought them very interesting.

Mr. S. C. Chapman (Torquay) said, with reference to the question of settling-ponds, in the water undertaking of which he had charge, they had put down one of these ponds at the head of the storage reservoir; and they found the results had been very good indeed. They had a wall at the higher end of the reservoir about 350 to 400 feet in length; and the greatest depth of water was 7 ft. 6 in. In this wall, they had eight openings, in which fine screens were placed. The screens had an area each of about 12·9 square feet. The mesh was parallel, and the spaces about 20 to the inch. The gauge of the wire was 21, and the area of waterway over the whole of the screen was about 3·5 feet. They found that the maximum flood they had to deal with ran to about 20 million gallons per day; and they had managed to pass the whole of this through the screens, with only 1 inch head. The result had been that the greater portion of the material carried down by the stream had been deposited in the pond; and it had only been necessary to clean this out about once in two years. This had saved a tremendous amount of work in cleaning out the reservoir; and at the present time he was putting down another of a similar kind. One was apt to lose sight of this sometimes—that, in the winter months, after the grass was dead over the gathering-ground, it got washed off into the streams. He had found over his screens a strong network of grass almost dissolved into a gelatinous matter; and this had so thickly coated the screens that it had to be cleaned off continuously. When it was dry, it could be pealed off in sheets, very much like rice paper. Of course, if the screens were not there, all this vegetable matter would pass right into the reservoir. There was one thing he had been endeavouring to do—that was, to get rid of this vegetable matter before it got into the screens, and, as soon as the whole of the grass was dry enough, to burn it off. They were now watching the results very carefully. With regarding to the planting of trees, he had been putting in trees now for several years; and he believed it was the right thing to do. In the first place, he put in larch. With fir trees of that kind, there was no undergrowth whatever; and tropical conditions did not obtain in England. Mr. Barham was right in what he said about cleaning off the forest to a certain extent, because in tropical countries it was the undergrowth and the large fleshy leaves of plants and things of that sort which would do the damage. He did not think they could compare the tree planting in England with the forest and other growths on a tropical watershed.

The President said a report of the discussion would be sent to Mr. Foster-Barham, who would be pleased to see that his paper had brought forth such a good debate. The author's reply would be published in the "Transactions."

TEST OF A PIERSON SUCTION GAS-PRODUCER.

At the recent Meeting of the Société Technique, M. Pierson gave some particulars in regard to a trial of one of his firm's suction gas-producers installed at the Rennes Gas-Works, in connection with which there is an electric station having two Otto gas-engines of 90-horse power each. The consumption of ordinary coal gas in these motors being rather heavy, it occurred to the Manager (M. Roche) that it would be more economical to work them with poor gas; and he selected a Pierson suction plant to produce it. It consists of a sheet-iron generator, with a cast-iron annular vaporizer, a condenser, washer, and purifier. The engine transformed to work with gas generated by this plant, developed 75-horse power. The trial took place in March last, and extended over eight hours, with the following results:—

Coke used	202·4 kilos.
Kilowatts produced	348·0
Horse power, at 662 watts	526·0
Coke used per horse power	461·0 grammes.
,, ,, ,, kilowatt	695·0
Average power developed	67·5 horse power.

The experiments showed that a kilowatt of electricity was produced with the consumption of 695 grammes (1½ lbs.) of coke. During the trial, the fire was stirred about every two hours—an operation which was rendered easy by the absence of clinker, which is a feature of the Pierson plant, owing to the low temperature at which it works.

With a suction gas-producer, an installation of electric lighting plant can be operated on gas-works under most advantageous conditions. In the first place, the fuel required—coke—is ready to hand, and in reckoning the cost of the current it can be valued at its full selling price. Next, the producer works almost automatically; for a charge in the morning suffices for a day of ten hours. The maintenance expenses are low, and the space occupied is small. No stand-by plant is required, as coal gas can be readily substituted for the producer gas, should this be necessary, without stopping the engine. Moreover, lean coal can be employed in the generator in place of coke, when the latter runs short, or when it is more profitable to sell than burn it. Finally, the installation expenses are light.

COOKING BY GAS IN LARGE ESTABLISHMENTS.

Interesting particulars in regard to cooking by gas in large establishments were furnished by M. Coudelou, the Manager of the Caen station of the European Gas Company, at the recent congress of the Société Technique. A new hospital was being built in the town, and the authorities were considering what system of cooking should be employed. The merits of steam, coal, and gas were carefully investigated; and eventually it was decided to have a trial of gas—this being favoured by the architect of the building. As M. Coudelou felt that he could not ask a stove-maker to put up a temporary installation, he sent up various appliances, and carried out an elaborate series of tests, the details of which are appended to his paper. During the period of the experiments, food had to be prepared for 458 persons, 320 of whom were patients and 138 were members of the hospital staff. The average daily consumption of gas was about 2300 cubic feet, against about 9 cwt. of coal. At the price charged to the ordinary consumers, there was a considerable saving in the use of gas as compared with coal. This fact, coupled with the other conveniences attending gas, dispelled the doubts of the hospital authorities; and they decided on employing gas for the culinary operations. The installation was to consist of a principal stove, 16 feet long and 6 feet broad, with eight large stewpans, twelve separate burners, and four ovens, a griller, a large hot-plate with drying compartment, two washing-up appliances, and a large stove specially designed for pharmaceutical purposes. The installation was laid out for doing the cooking for 600 persons. The results of the trials above recorded led the Committee of the Benevolence Office in the town to adopt gas in their kitchen. For this purpose, a stove 4 ft. by 9 ft. (with four large pots, eight burners, and a stewpan), was fitted up, and set to work. The first results obtained were very satisfactory; and subsequently the midday and evening meals were cooked with from 530 to 565 cubic feet of gas. These meals consisted of about 31 gallons of vegetable and meat soup, 12 lbs. of meat, 73 lbs. of vegetables, 6½ lbs. of fish, 2¼ lbs. of rice, and 7 pints of milk. These two examples of the use of gas for culinary purposes on a large scale appeared to M. Coudelou to be so good as to be worth bringing to the notice of his colleagues.

ILLUMINATING POWER & LIGHTING EFFICIENCY.

By W. R. Herring, of Edinburgh.

[A Paper read at the Forty-Fifth Annual Meeting of the North British Association of Gas Managers.]

It is no exaggeration to say that, where luminous-flame lighting prevails, the public do not obtain more than 50 per cent. of the light-efficiency which the initial standard of the illuminating power of the gas supplied warrants their getting—this being altogether apart from the very much higher efficiency obtainable by means of the incandescent mantle, a subject which I propose to deal with separately.

The low efficiency of luminous-flame lighting as compared with the official tests arises from the fact that in the majority of towns the test-burner differs materially, and is employed differently, from the burners in popular use whether they are the argand or flat-flame burners.

The City of London Gas Act, 1868, clause 43, prescribed for the first time the method of constructing the Metropolitan argand test-burner which, with slight modifications, has remained in use in the Metropolis and the provinces of England up to the beginning of the present year.

The Act prescribed that the burner shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by consumers. Here we have the first recognition of the principle that the test-burner should develop the highest efficiency from the gas burned. It is a fact also that the Metropolitan argand burner, in a more or less scientific form, was in practical use by consumers, although the annoyance arising from the use of a chimney, and the frequency with which it required to be cleaned, prevented it ever becoming a general favourite.

Mr. Hunt, in the year 1870, was, I believe, the first to investigate its merits, and to show that, by varying the height of the chimney employed, the illuminating power of the same gas varied considerably.

Since that date many investigators have also shown-up the defects of the original test-burner. But it was not until the beginning of the present century that its defects were fully acknowledged; and this arose at the inception of a lower power illuminating gas for the supply to the Metropolis by the South Metropolitan Gas Company. It was found that the burner used, as prescribed by the Gas Referees, inflicted a serious injustice upon any other than a straight coal gas of 16-candle power, for which the burner was originally designed. Even a 14-candle power coal gas was seriously depreciated—to say nothing of a mixture of carburetted water gas and coal gas, and other changes in the chemical composition of the gas, due to more modern methods of manufacture and a wider selection of material for its production.

The trend of gas legislation for some years past has been the abandonment of artificial enrichment. The vigorous policy pursued by Sir George Livesey and the Metropolitan Gas Companies has caused very considerable attention to be given to the subject of gas-testing during the past five or six years, and has resulted in a much more satisfactory basis being arrived at for determining the illuminating power of all grades of gases.

The early legislation in the case of the South Metropolitan Bill of 1899 and the immediately succeeding Bills of the Commercial and other Companies empowered the Companies to reduce the illuminating power of their gas and also to use the test-burner in a way differing from that originally prescribed by the Gas Referees. The London County Council, however, took exception to such modifications, and entered opposition to the Companies' Bills before Parliament. This resulted in very considerable attention being given to the method of testing gas generally.

These contests resulted in the Board of Trade appointing a Committee on the 25th of January, 1904—consisting of Lord Rayleigh, Chairman, Sir W. D. W. Abney, K.C.B., F.R.S., Dr. Robert Farquharson, M.P., Mr. William King, M.Inst.C.E., and Mr. James Fletcher Moulton, K.C., M.P.—to inquire and report as to the statutory requirements relating to the illuminating power and purity of gas supplied by the Metropolitan Gas Companies, and as to the methods now adopted for testing the same, and whether any alteration is desirable in such requirements or methods, and if so whether any consequential alteration should be made in the standard price of gas.

At the outset, it may not appear important to the members of the North British Association as to what is legislated for the "London Metropolis." But it is a fact that whatever is done in the case of the large London Companies forms a precedent, and is universally followed with regard to all gas legislation by Parliamentary Committees. It is, therefore, of equal importance to us as to our *confrères* across the Border.

This Committee reported on May 19, 1904, and, so far as the illuminating power test is concerned, they recommended the No. 1 Metropolitan argand burner to be used with a 6-inch by 1¾-inch chimney burning gas at the rate of 5 cubic feet per hour for all grades of gas.

The publication of this report, and the action of the London County Council—who, in 1905, promoted a Bill in Parliament which had for its object the enactment of the findings of the Departmental Committee—thoroughly roused the gas industry to a sense of the importance of the questions at issue. It practically resolved itself into fixing a hard-and-fast method of using what was already known to be an unsatisfactory burner in an unscientific way, to ascertain the illuminating power of all grades of gases, and entirely disregarded the spirit of the original clause in the 1868 Act, which provided that the burner should be such as is most suitable for obtaining from the gas the greatest amount of light.

When this burner is applied to the testing of any other gas than that for which it is designed, it gives erroneous results, in consequence of the air supply being out of proportion to the volume of flame. To overcome this difficulty those who were engaged in the controversy before Parliament brought before the Parliamentary Committee the necessity for either governing the air-supply to the burner, or deviating from the established 5 cubic feet rate of consumption, so as to ensure the volume of flame being constant—that is to say, that it had been found by a long series of experiments that provided varying qualities of gas were burned in the test-burner with approximately the same volume of flame irrespective of the consumption of gas, then the burner as originally constructed was found to yield fairly reliable and comparative results.

The Parliamentary Committees, however, did not care to deviate from the findings of the Departmental Committee, who recommended the retention of the 5 cubic feet rate of burning when testing the gas, and whilst the Commons Committee practically accepted the County Council Bill, we have to thank the Lords Committee for the establishment of what is an equitable and scientific system of testing, for though they retained the 5 cubic feet rate of consumption they also revived, with a slight modification and improvement, the old wording of the 1868 Act by reaffirming that the burner and its use shall be such as to obtain from the gas the greatest amount of light, &c., &c., and referred the matter to the Gas Referees to either devise or adopt a burner suitable to the purpose.

It was at this stage that Mr. Carpenter, who had already devoted a considerable amount of time to the consideration of this question in connection with his Company's proceedings, crystallized the experiments and investigations of others and himself, and invented what is now known as the No. 2 Metropolitan test burner, which may be simply described as an argand burner with a device for regulating the air supply to the inner and outer zones of the argand flame; and I cannot better demonstrate the utility of the invention than by showing the effect of an improper air supply upon the burning flame. [Demonstration made.]

As Mr. Carpenter has very recently dealt with the subject of this burner in a paper read at the meeting of the Institution of Gas Engineers in London, it is not necessary for me to do more than recommend every member of this Association to peruse Mr. Carpenter's paper, which has already appeared in the Technical Press.

Some of you may be thinking why so much bother about a test-burner for ascertaining the luminous value of gas when nobody dreams of using such a burner for practical illuminating purposes—a burner which, at best, yields only from a seventh to a tenth of the light that the gas will give if burned, in the now popular fashion, by means of incandescent mantles.

I will deal with this objection, which has much to prompt it, by simply pointing out the necessity of having some recognized standard whereby coals that are offered us for gas-making purposes may be relatively valued so long as luminous flame lighting is indulged in to any extent by the gas consuming public.

Where large quantities of coal are available, not only must the illuminating power be taken, but also its calorific power, and, as I will shortly show, a record of the flame volume per unit of consumption also taken note of. Flame volume is in my opinion a most important factor when determining the efficiency of a gas for incandescent burner illumination; and as flame volume depends upon the chemical composition of the gas, a complete analysis will also be necessary. By these means we shall be preparing ourselves for the day when the luminous flame will cease to have any influence upon our judgments when selecting our coal supplies. But as that day is not yet, it remains an economic necessity for the commercial control of the industry to establish a uniform method of testing, and I cannot recommend a better method than that which has been prescribed for the Metropolis. Although we are unable to burn 5 cubic feet of a 20-candle gas in the new test-burner, the results per foot of gas burning a lesser consumption are the same. Some results as to this have just come in this morning. From these, it is found that, burning at the rate of 3, 3½, 4, and 5 cubic feet, we get the same luminosity per foot, with the test burner, as with one at the 5 feet rate. So that, for all practical purposes, the burner is suitable for all grades of gas, apart from the principle of the 5 feet rate of consumption. But, as the bulk of our coal is even now of a class that yields from 14 to 18 candle power gas, it will be only when dealing with the cannels that any difficulty on this score can possibly arise, and these can be overcome by deviating from the prescribed 5 feet rate of consumption.

The flat-flame method of testing has prevailed in most towns where gas of higher than 18-candle power has been supplied. In Scotland, I suppose it is almost universal, as owing to the much higher standard of illuminating power which prevails, the old form of argand burner was altogether unable to consume it at the

rate of 5 cubic feet per hour. Nor will the new burner permit of such consumption on anything above a bare 20-candle gas. Its efficiency, however, is not impaired by reducing the consumption and correcting it in the ordinary way. I suppose I am right in saying that in Scotland we all require to use the flat-flame burner when testing, and to use it passing gas at the rate of 5 cubic feet per hour. Now it appears to me that the whole object of the Legislature in 1868, and reconfirmed in 1905, is to fix the normal rate at which the consumer requires to burn gas to get the illuminating power prescribed. This being the case, the practice of burning 5 cubic feet of (say) 25-candle gas for test purposes altogether fails to achieve this object, for the simple reason that the public seldom use flat-flame burners of so large a size, and we have all doubtless experienced the difficulty of burning our gas satisfactorily in the flat-flame burner at the 5 cubic feet rate. On the contrary, it would yield better results per foot of gas if it were burned at a lower rate in a smaller burner; and by so doing a nearer approach to the spirit of the Act and every-day conditions would be achieved.

It seems to me, therefore, that the time has now arrived when an early opportunity should be taken to codify the method of testing Scottish gas on lines similar to those which now prevail in England, and which are admitted by the great majority of gas engineers to be a fair and just conclusion to what has admittedly been a question which has raised considerable confusion in the public mind, and in many instances imposed an injustice upon the gas undertakings.

Another misnomer with regard to the practices of flat-flame testing is the fact that there is no such thing as a standard union-jet burner yet accepted and verified by the Standards Department of the Board of Trade. All they have is the 20-candle slit-union, which was made and used when the City of Westminster was supplied with a 20-candle cannel gas. The question, however, remains, Has illuminating power any practical effect upon lighting efficiency at the present day? and I answer emphatically that for all practical purposes, so far as the public are concerned, luminous flame value is of no importance whatever. The Legislature in 1868, as well as in 1905, decreed that the burner, so long as it was within reach of the general public, should be such as to develop the best efficiency from the gas. The public to-day have within their reach a burner that will give them a seven to ten fold better light from the gas than can be obtained with the most scientific luminous flame burner extant. This fact in itself renders luminous flame testing, from the public point of view, little else than an absurdity; for neither luminosity nor calorific power alone accounts for the efficiency of the gas when burned in an incandescent burner.

During the past six years I have had occasion to devote very considerable time to investigating the phenomena which go to make up the efficiency of the light emitted by an incandescent burner, and have been directing an investigation into the causes which enable gases of various luminous flame values to render the same illuminating power when burned in the incandescent burner. I have had the opportunity of dealing with many grades of gas ranging from 12 to upwards of 30 candle power.

It is generally believed that calorific power alone is to be the governing factor in the future; but my investigations warrant my saying that there is at least one other important factor to be taken into account at the present day when determining the value of a gas for lighting purposes. The visible luminosity and calorific power do not alone account for the results obtained when using the gas in incandescent burners, nor can the question of flame temperature alone account for the results. I have, however, no hesitation in saying that flame volume is a factor of even greater importance than calorific power.

It will doubtless have been noticed by many—particularly with flat-flame testing—that a considerable change in the volume of flame when burning at the 5 cubic feet rate is observable without affecting the luminous value of the gas. Then again a 25-candle carburetted water gas yields a much smaller flame than a 25-candle coal and cannel gas; and yet the flame temperature of the carburetted water gas is slightly higher than that of the coal and cannel gas. If, however, the volume of flame is insufficient to properly envelop every fibre of the mantle, then neither calorific power nor flame temperature can play its part and develop the highest degree of luminosity in the mantle.

Flame volume must be dependent upon the chemical composition of the gas, which I have found can vary very considerably for gases of the same luminous value and approximately the same calorific power.

For some years past it has been our custom when testing the many coals which pass through our hands each season to not only take the complete chemical analysis of the gas, its calorific power, flat-flame and argand luminosity, but also its luminosity when burned in an incandescent burner; and I am enabled to set before you in statement form some important information bearing upon the questions raised.

A glance at Table A will show the members to what extent the presence of the unsaturated hydrocarbons can vary in approximately the same illuminating power gas, and further the comparatively close range of the calorific power of the same gas notwithstanding its very variable chemical composition. For instance, an average 16-candle gas contains 3·76 per cent., but ranges from 3·1 to 4·6 per cent. of the unsaturated hydrocarbons; and a similar disproportion will be observed amongst the higher-grade gases. Up to 20-candle power the tests in this series were

TABLE A.—*Results of Experiments on Various Grades of Gas yielded by Different Coals under Test, setting forth the Illuminating Power by the Metropolitan No. 1 Argand Burner, the Chemical Composition of the Gas, and the British Thermal Units.*

Candle Power per Argand, burning 16-Candle Power flame, Corrected to 5 Cubic Feet Rate.		Percentage Composition of Gas.					B.Th.U. Gross per Cubic Foot.	Candles per Cubic Foot.	B.Th.U. per Candle per Cubic Foot.
		Unsaturated Hydrocarbons.	Unsaturated Hydrocarbons per Candle.	CO.	CH_4	H.			
16·02		2·5	·156	12·9	22·2	62·4	595·2	3·20	185·70
15·08		3·1	·205	14·0	19·5	60·0	573·3	3·01	190·00
15·95		3·2	·200	10·1	25·5	59·3	607·3	3 19	190·40
15·73		3 3	·209	13·9	22·9	51·5	575·0	3·15	182·75
16·19		3·4	·210	13 8	21·4	58·6	585·4	3·24	180·75
15·86		3·5	·220	11·7	24·3	59·8	602·8	3·17	190·00
16·08		3·6	·223	10·4	22·2	60·6	580·5	3·21	180·50
16·16	Average	3·7	·229	12·6	22·5	59·7	590·4	3·23	182·65
16·20	15·97	3·8	·234	14·3	24·5	51·2	596·3	3·24	184·05
16·40		3·9	·238	12·8	23·0	57·0	599·9	3·28	182·90
16·02		4·0	·249	12·6	22·2	60·1	590·4	3·20	184·25
15·67		4·1	·261	13·1	25·0	51·7	588·2	3·13	187·65
16·30		4·2	·258	13·8	20·7	58·6	587·8	3·26	180·30
15·72		4·3	·273	13·9	24·0	51·3	587·8	3·14	186·95
16·30		4·6	·282	14·3	20·6	58·1	588·7	3·26	180·55
16·69		4·7	·281	12·3	21·7	55·0	610·2	3·34	182·80
17·29		4·8	·277	12·2	26·0	53·9	605·6	3·46	175·10
17·73		4·9	·276	12·5	25·1	53·0	616·3	3·55	173·80
18·91		5·0	·264	10·6	22·5	59·9	635·5	3·78	168·00
18·53		5·2	·280	10·6	22·9	60·7	633·6	3·71	170·95
18·95		5·5	·290	10·8	23·2	57·5	630·8	3·79	166·45
18·35		5·7	·310	10·8	26·0	53·8	633·1	3·67	172·50
19·50		5·9	·303	9·8	28·6	55·3	640·9	3·90	164·30
19·33		6 0	·310	11·0	26·5	54·4	656·7	3·86	169·85
19·53		6·4	·327	12·2	23·6	54·3	647·1	3·91	165·65
20·98		6·5	·309	8·9	29·2	54·8	672·8	4·20	160·35
20·93		6·9	·329	11·7	24·5	55·7	670·1	4·19	160·05
20·51		7·3	·356	9·7	23·0	59·7	670·9	4·10	163·55
20·57		7·5	·364	8·9	28·4	53·4	679·6	4·11	165·15
Flat-Flame.									
21·12		7·7	·364	9·7	21·5	53·3	676·3	4·22	160·10
24·35		8 0	·328	9·0	28·8	52·5	700·3	4 87	143·80
25·74		8·3	·322	8·2	27·9	54·2	720·4	5·15	139·90
26·93		8·4	·312	9·5	29·6	50·9	736·0	5·38	136·65
25·75		8·5	·330	8·4	29·4	53·0	734·0	5·15	142·50
30·15	Average	8·7	·288	9·5	29·2	51·0	728·9	6·03	120·85
28·03	27·86	8·8	·314	8·2	28·6	53·7	737·6	5·61	131·55
27·69		9·7	·350	7·7	26·2	55·8	759·5	5·54	137·15
29·14		10·3	·353	7·7	29·1	52·5	778·9	5·83	133·65
30·22		10·7	·354	7·3	29·4	52·1	784·1	6·04	129·70
30·63		11·2	·365	8·2	35·6	40·1	801·5	6·13	130·80

Average 3·76 (Unsaturated Hydrocarbons); Average 9·26 (Unsaturated Hydrocarbons per Candle).

TABLE B.—*Giving Candle Power Yielded by Various Coals under Test, Percentage of Unsaturated Hydrocarbons Present, Candle Power per Unit per Cent. of Such Hydrocarbons, and British Thermal Units per Candle of Illumination.*

Candle Power Per Argand Burning 16 C.P. Flame Corrected to 5ft. Rate.	Unsaturated Hydrocarbons. Per Cent.	Unsaturated Hydrocarbons Per Candle. Per Cent.	Gross B.Th.U. Per Cub. Ft.	B.Th.U. Per Candle Per Cub. Ft.
14·68	3·8	·258	560·7	38·19
15·61	4·22	·270	584·5	37·44
16·41	4·42	·269	598·3	36·46
17·19	4·65	·270	610·1	35·49
18·59	6·0	·322	633·8	34·09
19·49	6·63	·340	647·7	33·23
20·44	6·62	·323	676·3	33·08
21·12	7·7	·364	676·3	32·02
22·47	7·9	·351	706·4	31·43
23·51	8·4	·357	733·2	31·18
24·45	9·7	·396	759	31·04
Flat { 25·45	9·4	·369	750	29·46
Flame { 26·57	10·7	·402	790·2	29·74

taken with the argand burner; but above that the fla t-flame burner had to be resorted to. Turning to the column under the heading of "Calorific Power," it will be seen how closely the calorific power ranges and advances with the increase in the illuminating power, but not in the same ratio per candle of illumination. Taken by itself, therefore, this statement exhibits a very strong argument in favour of the retention of high-grade gas. I will, however—from experiments made at the same time—be able to show that the same luminous intensity can be obtained from a 15-candle gas as is yielded by a 20-candle gas when burned in the incandescent burner.

Reverting again to Table A, it will be seen that a 16-candle gas containing 3·76 per cent. of the unsaturated hydrocarbons compared with an average of 27·86 candle gas containing 9·26 per cent. contains two-and-a-half times as much of the unsaturated hydrocarbons. The illuminating power is only increased by 74 per cent., whereas the increase in the percentage of the illuminants present should have yielded, in the same ratio, practically 40-candle gas, or an increase of 148 per cent. This shows conclusively that a very much lower efficiency is obtained when burning the high-grade gas as a luminous flame. This low efficiency when burning a high-grade gas can be further demonstrated in a different way, and is shown in Table B, which sets forth another and separate series of tests on gases yielded by various coals different from those dealt with in Table A.

Again dealing with the 15 to 16 candle series, it will be seen that there is 0·270 candle of illumination per unit per cent. of hydrocarbons present in the gas; and as we advance above the 17-candle quality the percentage of hydrocarbons necessary to yield one candle of illumination increases with the increase in the flame luminosity of the gas. British thermal units are again given for this series of tests, and British thermal units per candle; the latter column again showing a loss of efficiency with the high-grade gas.

In carrying out these and other investigations, I was often mystified with gases of comparatively low illuminating and calorific power yielding as good and sometimes better results with the incandescent burner than other gases of higher luminous value. Flame temperature naturally suggested itself as a solution of this problem, but did not satisfy me as being the only factor. I, therefore, again had recourse to our records, and prepared a statement which would show me the candle power by incandescent burners in relation to flame luminosity and the calorific value of different gases.

From our books, therefore, we first abstracted the tests which yielded from 30 to 32 candles per foot of gas when burned in the incandescent "C" burner. Against each of these results the candle power ascertained by the argand burner is given in Column No. 3, and in Column No. 4 the calorific power. In each case the incandescent burner was used so as to yield the highest efficiency by a proper regulation of the gas and air supply. The candle power of the gas was ascertained by a No. 1 Metropolitan argand burner used to a 16-candle power flame; and the calorific value by Junkers calorimeter.

This statement gives some remarkable results, and goes a long way to challenge the present-day belief that calorific power alone is to be the factor governing the supply of the future. Glancing at the statement a moment we find that a 15·35-candle gas of 590 B.Th.U. yields the same illuminating power by the incandescent burner as a 20·32 candle gas of 668 B.Th.U. A further glance at the third column will also show that gases of 15, 16, 17, 18, 19, and 20 candle power luminous value all yielded practically the same degree of illumination per foot of gas when burned in an incandescent burner using the same mantle with each test. Nothing could, I think, be more conclusive than this last statement as to the incorrectness of the policy of continuing to supply gas judged by its luminous flame value.

Incidentally, Table C also confirms what I have formerly stated as to the calorific power of the gas rising and falling with its luminous value; for it will be observed that the calorific power of the highest candle gas on the list is also the highest calorific

TABLE C.—*Showing Candle Efficiency by Incandescent Burner in Relation to Flame Luminosity and Calorific Value.*

"C" Incandescent Burner. Candles per Foot.	Rate of Consumption per Hour. Cubic Feet.	Candle Power of Gas, No. 1 Argand.	B.Th.U., Gross.
30·36	..	16·50	625·2
30·00	3·34	16·70	617·3
30·80	3·16	17·45	640·3
30·70	3·40	16·98	620·5
31·00	3·30	17·78	616·1
30·93	3·31	17·58	617·3
31·71	3·27	19·92	663·8
31·34	3·27	19·04	606·6
30·59	3·37	20·32	667·7
30·18	3·36	18·49	626 4
30·57	3·34	19·43	643·1
30·45	3·33	19·82	663 0
30·71	3·37	18 08	617·7
31·51	3·10	19·03	637·6
30·37	3·19	18·54	636·8
30·62	3·06	18·63	609·4
30·38	3·18	16·62	596·3
30·57	3·17	18 40	627·9
30·18	3·35	17·34	640·4
30·52	3·27	16·77	610·6
30 38	3·40	15·57	572·8
31·88	3·02	17·82	639·5
31·20	3·06	17·30	631·2
30·54	3·33	16·41	618·9
30·47	3·39	15·35	589·9
30·47	3·40	15 60	572·8
30·17	2·89	18·46	634·6
30·47	3·18	17·91	629·8
30·32	3·10	17·54	625·6
31·93	3·31	16·77	627·6
Gas and air regulated to yield highest result.		Gas burned to 16 C.P. flame and corrected to 5 c. ft. rate.	

NOTE.—Consumption on incandescent burner ranged between 2·89 c ft. and 3·40 c. ft.

power and likewise that the 15-candle gas is the lowest calorific power.

In conclusion, I would like to place on record my thanks to Mr. J. G. Scott, the Edinburgh Works Chemist, who has suffered the monotony of taking the hundreds of records in a most able, careful, and painstaking manner, and from which I have been enabled to draw the conclusions upon which the subject of my paper is based.

Discussion.

The PRESIDENT said he was sure the members regarded the paper as a most important one, and one which was worth their careful consideration and discussion.

Mr. A. YUILL (Dundee) remarked that the paper was of such a nature that very little room, and very little material, was left for the members to debate. Mr. Herring had given them, in the first place, the historical aspects of the case; secondly, the practical research; and then the application—very much as the old ministers usually did. In this application they were all pleased to find the recognition given to the scientific research that had been made on the question, by the adoption of a burner which was so designed as to give them the maximum amount of light for the gas consumed, irrespective of the quantity. As had been mentioned before, there were some papers so brimful of useful matters that they were more in the form of lectures. He looked upon Mr. Herring's paper as one of this kind. The author had touched upon the reduction of the illuminating power; but the idea had occurred to him that there were other matters to be considered, more especially in practical working, than the mere lowering of the illuminating power and the saving it effected. Some of the older members might remember the time when they only saw in print the serious troubles which their English friends had with naphthalene; but those who now favoured gas of low illuminating power which was obtained from coking coal particularly, had now seen naphthalene in other forms than they were accustomed to. This was a matter that required to be taken into account by everyone who was considering the question of the reduction of illuminating power. He thought he could safely say that with the coal they had in Scotland, anyone going down to 16 candles would create a bogey which would at once cause him no end of trouble and inconvenience. In some cases they might find—and this was a point which required to be borne in mind by everyone of them—that they would require to ask themselves whether it would be better to save a little in illuminating power, and have trouble with naphthalene, with its consequent expense. In considering the question of the illuminating power of gas, most of them now recognized, as had been shown in the burner before them, that to get the maximum light-giving matter in the incandescent mantle, the volume of both the gas and the air required to be strictly under control. Mr. Herring had emphasized the necessity of study, and of further research in the matter of the hydrocarbons. This was a question they ought all to seriously consider. And in a question of illuminating power, to his mind the calorific value, the flame volume, and the flame temperature undoubtedly all affected the luminosity they obtained from the incandescent burner. But there was one matter on which he thought Mr. Herring, from his experience of carburetted

water gas, would bear him out, and that was the difference the application of carburetted water and enriched gas made to the luminosity of an incandescent burner. He always found that, even supposing he only mixed 10 per cent. of carburetted water gas with ordinary coal gas, it at once caused the incandescence to burst out to a greater degree than in the case of ordinary coal gas itself. To his mind, this was not got from its calorific value, because they were lowering it. Allowing the illuminating power to be the same, it must be caused either by the flame volume or the flame temperature, which was only the result of the mixing or combination of various hydrocarbons that were obtained in carburetted water gas. This required careful study and research; and if Mr. Herring's paper had no more effect than to awaken in them the desire to know more of this complex subject, the author would be well rewarded.

Mr. D. Vass (Airdrie) remarked that the paper opened up an entirely new field of thought for the members. They had all lately been considering that the calorific value of gas was to be a part of the testing of the future; but Mr. Herring gave this a little knock on the head, and told them that there was something more. He said that flame volume had to be considered; and perhaps it would help them to understand it if Mr. Herring would kindly tell them how he arrived at the flame volume. Was it by bringing up his flame to a constant size as well as to a given incandescence of the mantle, or in some other way? It seemed to him that they would require to change their ideas slightly, to the newer form, because these tests had been carefully made, and the fact was established that they had the two things to measure—calorific value and flame volume. In thinking over the matter, it occurred to him that they might get a permanent standard incandescent material—such as platinum—which, exposed to the flame, would measure both the heat value and the flame value at the same time; the area of incandescence being covered in (say) a mesh of platinum wire gauze. The only way they could measure this again, would be by electricity—*i.e.*, the volume of resistance that it would offer. Perhaps this was something like the leading which a paper such as that now before the meeting would give them—a new form of testing entirely, from the old style of the disc photometer.

Mr. A. Wilson (Glasgow) was sure they were all indebted to Mr. Herring, for more reasons than one, for bringing the subject before the Association, in a scientific way, which, he thought, had not been done before. His main thanks were due to him for bringing the subject of the testing-burner before them in Scotland. Several of them had had the matter in their minds for a considerable time, because they felt an injustice was being done to them through the use of the flat-flame burner; and they did not see their way to adopt the "London" argand burner in its old condition. Mr. Herring had, however, shown them a burner which would meet with general approval, for works of all sizes throughout the country, and for Scotch gas as well as for English. He had shown them a burner which, in practical testing, gave the same justice to all qualities of gas. He thought the time was not far distant when the burner would be adopted by everyone who had the subject of testing in his hands. The President, he believed, had had the burner put into his Act, and was going to use it for testing his gas; and others of them had arranged that, on the first opportunity, they would do the same thing. The point made by Mr. Herring as to the value of coal was a most important one. In testing coal of various qualities, some used the argand, others the flat-flame burner. In Glasgow, a few years ago, the flat-flame burner was invariably employed in testing coal, to the great disadvantage of some of the lower qualities. Lately they had tested them both by the flat-flame, to keep up their old comparisons, and also by the argand; and they were now doing it by the "Metropolitan" No. 2 argand burner. They found that this gave a great advantage. It made quite a difference—especially when they came down to 14 or 15 candle gas—from a particular coal. The lower qualities of coal had not been fairly dealt with in the past, and they were now more likely to receive justice in their annual contracts. Another reason for the adoption of the "Metropolitan" No. 2 burner was, he thought, that they would have a more ready means of comparing the gas supplied by the various municipalities and gas companies throughout the kingdom. They took credit, here and there, for supplying gas of various qualities; but it was seldom brought out how the gas was tested. If every town's gas were tested by a standard burner, they would have a fair comparison. He knew that in some towns they were using the argand burner for testing; and it made a great difference. He had no desire to raise the old bogey of high *versus* low grade gas; but he thought that Mr. Yuill was certainly raising a bogey about naphthalene. In a great many places in Scotland gas of not much above 15 candles was being made. Often the gas was enriched by benzol; but they had the lower quality of gas all the same, and they had very little trouble with naphthalene. In one of their works in Glasgow, where they enriched with oil gas, they made from 12 to 14 million cubic feet per week of 15½-candle gas, for some years; and as long as they enriched with the oil, this was all the quality that was made in the works. The enrichment was put in after the gas had left the works; but the trouble with naphthalene was very slight indeed. Certainly there was a little, but nothing to be afraid of. So he did not think this need bother them. The main factor, of course, to be taken into account, in high *versus* low illuminating power, was the coal which could be most economically supplied in the district. He could say nothing on the matter of flame volume, because he had not made any tests. At the same time, it was quite right to bring forward this new matter of the flame volume; and, on thinking over the subject, he certainly thought it ought to have a great bearing upon the luminosity of the incandescent mantle. Where water gas was employed, they had a short flame, and they obtained a higher illuminating power at the lower portion of the mantle; but for the illumination of a room, it did not have quite the same effect as a mantle which was fairly equally illuminating all over. So that there seemed to be something which might help them in what Mr. Herring said with regard to flame volume.

The President was sure there was no gas manager present who had not observed the phenomenon which Mr. Herring had commented upon; but they could not explain it. Mr. Herring had told them what it was. If they looked back to the days when they enriched gas with cannel, and took an observation with a 5-inch jet, and changed again to enrichment with shale, what did they find? They found that when they enriched with coal, they had a 5-inch flame, and when they enriched with shale they had a 5 to 6 inch flame. He thought that Mr. Macpherson, of Kirkcaldy, could tell them something about this, because he looked upon him as really the father of this theory; but he (the President) was a very good disciple of it, and was working it to-day. They had all noticed, however, that which had been pointed out with regard to flame volume, and did not understand it. They were not all able to treat the subject in a scientific way; but let them, at least, look at the matter from a popular point of view, and he was sure there were many present who would help them by giving their experiences.

Mr. S. Milne (Aberdeen) wished to say how delighted he was with the paper, and the way it had been put before them. He thought it was very desirable that they should have a uniform burner, so that they might know what they were doing. At the present time, their standard was a union-jet burner. Till about three years ago he used an iron burner—a union-jet burner certainly, but constructed of iron; but he found, about this time, that, by using a Bray burner with a steatite tip, he was able, with the same consumption of gas, to get 2 candles more. They might be sure he took care to introduce it; and so he was really working now with a gas of about 2 candles less quality, under the same name. In the near future, they were to seek to have their illuminating power reduced. At present, it stood at 20 candles; and although he was not a defender of low-quality gas, still he thought they should have their standard reduced, so that they might, at some future time, should they find it desirable or necessary, come down to a lower standard. He should certainly remend the introduction of this new burner—the "Metropolitan No 2." While it was quite the case, as had been clearly demonstrated by the figures before them, that the flame volume had an appreciable effect upon the incandescent mantle, he did not see that the flame volume would have any appreciable effect upon the gas used for any other purpose—such, for instance, as motive power, cooking, or heating; and, unfortunately, flame volume was a thing they had no control over. It was a very interesting fact to bring before them; but if they were both to increase the flame volume of their gas, how were they to do it? They had no control over it. They had some control over the calorific value, as was indicated in Statement A, in which Mr. Herring showed that the calorific value varied very nearly in proportion to the candle power; and, from his own observation, he found this to be the case. Referring again to the bogey Mr. Wilson menttoned, of high *versus* low quality gas, he thought he struck the right note when he said that corporations and companies should use the coal that came most conveniently to them. That was to say, in Glasgow they could get coal to produce from 15 to 18 candle power gas, and they supplied gas of 18 candles, which he thought was very wise; but they in the North were very much further away from the coalfields, and they liked to bring in coal with gas in it. They found that coal with 9500 cubic feet of gas per ton in it was no cheaper than that giving 11,500 cubic feet; and the carbonizing costs of these two different classes of coal were identical. So that the geographical position of the town was a consideration which must be taken into account in fixing what was a suitable candle power for every particular town.

Mr. J. Napier Myers (Saltcoats) was not able to handle the subject in a scientific way. He had very little experience with the photometer. His observations were, as the President described, of a popular character—just what appealed to the eye. There was one conclusion in the paper which he was especially thankful to see stated with the authority that Mr. Herring could give. This was that, for all practical purposes, there was little difference, so far as the public were concerned, in the luminous flame value; that it was of no importance, whatever, whether they gave 15 or 20 candle gas, if these gases were used in conjunction with the incandescent mantle—the lighting effect being practically the same. He thought it an important matter to have this set out so clearly and tersely as they had had it that day.

Mr. A. Bell, sen. (Dalkeith), thought the paper more a lecture than a paper for discussion, Mr. Herring had left no loopholes, no room, for discussion, for his paper had been so exhaustive. There was hardly a gas manager, however small his works, but found a great difference between burner and burner, when burning, as he thought, the same quality of gas, perhaps the same quantity; and probably Mr. Herring would tell them how he

arranged the flame volume. It was a very important matter for them. He was one of the old school. They had lost their main champion of high-power gas. But it was a matter of the best result which they must now give effect to; and Mr. Herring had shown them that they could get the same illuminating results from a low-quality as from a high-quality gas. Therefore a high quality was a perfect waste. Day by day more incandescent burners were being used; and he thought the day of the flat-flame burner was nearly at an end.

The PRESIDENT moved a very hearty vote of thanks to Mr. Herring for all the trouble he had taken in bringing the matter before them. Mr. Herring's experience had been invaluable in this respect, because he had had exceptional opportunities of testing coal. He himself had had the opportunities, and he had taken advantage of them to the fullest extent. They had all had opportunities to make the same tests, although, in the case of many of them, upon a small scale; and they had not been able to do so, possibly within such a short time. But a good many of them had been long enough in Scotland to have been able to arrive at a fair estimate of the various coals available; and they could corroborate what Mr. Herring had said in his paper.

Mr. HERRING, in closing the discussion, remarked that he quite agreed with what Mr. Yuill and Mr. Bell said as to the paper, apart from its introduction, being rather of the character of a lecture, because it was practically a statement of facts—of investigations which, he might say, were spread over five or six years, and were not started with the object of being put into the form in which they were before them that day. It was simply when their President requested him to do something at this meeting, and on account of his desire to render any help that he could, that it occurred to him that the subject might be dealt with. At that time, particularly, his views were more with regard to instituting a uniform system, or a more scientific system, of testing gas than at present prevailed in Scotland. However, when they got started on a trail, they never knew where they would finish; and he ultimately found himself on what, he believed, was a somewhat new aspect of the question with which they were dealing. As to the matter of the reduction of the illuminating power, which Mr. Yuill said he did not look upon so much from the point of view of economy, he had already shown that, from an economical point of view, he could give the citizens of Edinburgh very little advantage in the price of gas if they were to drop down from 25 to 15 candles. They happened to be so placed as to be within a very short railway carriage of one of the best cannel-producing districts in Scotland. Consequently, the value of enrichment to them was not great. His point of view was the delivering of the gas to the public. They all knew that in cold weather the carrying power of the gas was practically in proportion to its illuminating power. That was to say, the richer the gas the more difficult it was to deliver to the consumer, because of the hydrocarbons—which, after all, were only vapour—in it being reduced to a condition of tar. He had been carrying out some elaborate investigations on this point for a year or two now; and they were at present engaged in gradually reducing to scale the quality on delivery, so as to see what was the loss on a given mileage—that was to say, between Granton and Edinburgh. When he first came to the North, he had very great doubts—although he knew that 25 and 26 candle gas was being made at the respective works—as to the quality which was delivered from the central gasholder station, about 2 miles away; and he took steps to have records made, so that they might have them in their books for reference at any future date. He might say there was a loss, at times, of as much as 5 candles between the Leith works and the Canonmills holders, and from the Edinburgh works (which were nearer) of over 4 candles, in cold and bad weather. This investigation led him to advocate the necessity of producing a less illuminating power, and to rather look to producing a permanent gas—one which they could deliver to the consumer, because, at the present time, gas would fall one day, or one part of a day even, and it would pick up the next day, or part of the day; and the consequence was that the consumer, instead of having the uniform quality which he desired, got gas of variable quality. Thus, therefore, his views with regard to the reduction of the illuminating power of the gas were not altogether on economical grounds, but were more for the benefit of the consumer. Mr. Wilson seemed to depreciate the idea of the naphthalene trouble with low-grade gas. He must say that he held his views, though he did not put them in the same way. Assume, for a moment, that they would have naphthalene troubles, on the other hand they knew perfectly well that one of their own members had brought out a process, which was as simple and inexpensive as could be, that had completely done away with the naphthalene trouble in English gas-works. He had been on the other side of the Border; and he knew what these troubles were. He had seen an 18-inch pipe choked up to a 4-inch bore with the stuff; but he knew they had methods at hand now which added practically nothing to the cost of manufacture, and which would get rid of this trouble. Mr. Yuill raised the question of volume of gas and the regulation of the air. He had already shown in his paper the necessity for proportioning the air supply to the quantity of gas they were burning at the moment. This still more emphasized his remark that they must have a uniform standard of gas. On the question of carburetted water gas, he agreed with Mr. Wilson rather than with Mr. Yuill. They obtained a greater intensity of luminosity at the foot of the mantle; but unless they burned more gas, they did not get the mantle fully inflamed. Mr. Vass dealt rather with the issue as to how they were to arrive at the flame volume. Well, he had not got as far as that at present, because he had only discovered the facts, he might say, in getting together his paper, from the records they had made; and some means must be devised of measuring the flame volume for testing purposes. All he did know was that the same quantity of gas, of different illuminating powers, gave them the same effect, on an incandescent burner. Whether they could depend on a measurement of the flame volume by means of a jet, or by a carefully adjusted bunsen burner, were matters of experiment—matters which they had still got to closely investigate. Mr. Wilson seemed to be quite in favour of the "No. 2 Metropolitan" test burner as the proper one to adopt for Scotland. He was of this opinion himself. He did not know until he glanced through the presidential address the previous day that it was already established; and he must congratulate their President on having introduced it at Perth. He thought he could depend upon pretty influential support for getting it established in all other works where testing was carried on under the Gas-Works Clauses Act. Mr. Wilson also referred to the question of flat-flame testing of coal, which, no doubt, was the universal practice in Scotland; and it occurred to him that if they were to test the ordinary English coal with a flat-flame burner only, it would be nearer 10 candles than they thought. There was no doubt that it was unjust to test coal with a flat-flame burner. There was, as Mr. Milne brought out, no such thing as a standard union-jet burner. Within the last six months he called at the Standards Office of the Board of Trade, and asked them to show him a standard union-jet burner. They did not keep a standard which they could put forward; yet many of them in Scotland were tied down by Act of Parliament to test their gas by such a burner—a burner which was not a standard. They might as well be asked to weigh their coke with a scale constructed by themselves. It was, therefore, manifestly unfair to the industry, and misleading to the public, for them to continue to use a flat-flame system for testing—testing with a burner which had not been standardized, and which they had all to buy in the market, and pay a penny each for. The President added some very practical views, which he was glad to hear, with regard to this very question of flame volume, which, he admitted, he knew very little about. All he knew was that it was a factor of the greatest importance. The President pointed out that there must be many present who had noticed, in the height of the jet, that the same quality of gas was produced from different coal. This was the whole basis of his contention—that different coals would be found to yield gases which would give them a different volume of flame for the same consumption, in the same way as they gave a different illuminating power and calorific value. It was these differences that they had to discover. Mr. Milne asked how they were to arrive at them. But if they discovered that certain coal gave more flame volume, and consequently more illuminating power, in an incandescent burner, then they should judge them on that basis, as they were doing now. He meant it was a matter of finding out which coal gave the best result, including the calorific power and flame volume, and to make use of these tests instead of the sperm value tests at present employed. One coal might give them the calorific power with small flame volume; and in order to completely envelop a mantle with this gas, they would require to burn more of it. Mr. Milne's remark as to the effect of flame volume on power gas and gas used in stoves and other apparatus, was quite a proper one. He had not had time to investigate it; but he should explain that the gas which gave a higher flame volume would be more effective in a gas-engine, because the degrees of compression and expansion would be greater than in the one which gave the smaller flame. And then, probably, if they found it to be case that gas of higher flame volume illuminated the incandescent mantle more efficiently, they had a right to conclude that it would also illuminate the balls of a gas-fire. They only had left the question of calorific power as applied to cooking and heating purposes. There, of course, calorific power was the all-important factor. Mr. Bell had also added a side-light to the difficulties one must have in dealing with this subject. He pointed out that with the same gas he found trouble in regulating the incandescent burner to give the best light. There, again, they went back to the question that at the first mystified him—How it was that, with the same illuminating power, they got these grades of luminosity in an incandescent mantle. Mr. Bell asked a question as to the method of using the incandescent burner in testing. He (Mr. Herring) might say that he tested on a photometer. He turned on the gas until he saw that he had the best flame, and, regulating the air supply, took a few readings. The pressure was about 15-10ths.

A MEMBER: Over all the tests?

Mr. HERRING said he thought he had explained in his paper that the burner was adjusted to give the best possible results before taking the readings—that was to say, it was probably tested at various pressures of gas, at various heights. They got the best possible luminosity from a burner, and then ascertained and recorded the conditions under which it worked. He believed he had covered fairly well the points which had been raised. This was a question that was by no means settled where they left it; and it was one which he was quite sure all of them could assist in solving, and probably adding to their information.

SOUTH-EAST OF IRELAND GAS ASSOCIATION.

A Meeting of this Association was held at the Fermoy Gas-Works on Monday of last week—Mr. G. LENNON (Dungarvan) in the chair. There was a good attendance.

After luncheon, on the invitation of the Fermoy Gas Company, members assembled in the Manager's office, where the meeting was held.

Mr. D. W. TOOMS (Fermoy) read the following paper:—

NOTES ON THE DISPOSAL OF GAS TAR.

Having been called at very short notice to read a paper before this meeting, I have only been able to make a few notes on the subject of the disposal of tar, a discussion on which should be of some benefit to us, as I am sure the members will agree with me that tar is at present a drug on the market, and is getting increasingly difficult to dispose of at a remunerative price. Up to the present we have not been very hard pushed in disposing of our tar, probably owing to associated management; but the general report throughout the country is that this product is becoming hard to sell.

The object we have to aim at is to find an outlet for this surplus tar; and to this end it behoves us to encourage its use for every purpose to which it is applicable, by using as much as possible on our own works (for tarred roofs, asphalte yards, paths, &c.), by utilizing it as fuel, or by opening up some new market for it.

At the Fermoy town gas-works, all our roofs are of felt, and have, I understand, been in use for more than thirty years. Against this there is over the retort-house at the military gas-works a roof constructed of galvanized iron, which has been fixed about six years, and is now perforated and hanging in threads, and which we intend to replace with felt. This roof has had all possible care, as it has been painted every year. I think this clearly demonstrates the immense superiority of felt over sheet-iron roofs.

Another use for tar is for making asphalte paths, although we in Fermoy have done very little in this direction. I am, however, about to construct an asphalte footpath from our works to the creamery (about 300 yards); and I hope this will lead our local authorities to adopt it in laying new paths. I am of opinion that this use of tar could be greatly extended by the display of some energy on our part.

I have been experimenting for some four or five months in burning tar through my producer; and although I have not yet got it to my liking, I confidently hope to bring it out of the experimental stage before the summer is over. I have met with considerable difficulty, a good deal of which I have overcome. For instance, the furnace would go well for two days, and then the heats would fall, owing to a very dense lump of carbon forming, which I had to take out. I could only get over this by using the thin tar, which contains a good deal more of the light oils than the thick hydraulic tar. My chief difficulty has been with a deposit of lampblack in the gas-flues; and when I have overcome this, I shall be very near the solution of the problem. These chokes have made my progress very slow, as when they have occurred I have had to shut off the tar for about a week, until I got it cleared out, my heats back, and stock up. But, *nil desperandum*. I rather fancy I shall be heating my retorts constantly with gas made from tar before the winter is on us.

There is one other point I must touch upon—viz., the maintenance of roads. There has been a good deal of discussion throughout the country on the dust problem, owing to the general use of motor cars, which, under ordinary circumstances, are a great nuisance, as, travelling at a high speed, they disintegrate the bonding of the roads, and throw up huge clouds of dust all over the countryside—destroying innumerable crops, as we learn from our notoriously patient friend the farmer. This question is now being taken up by many of the local authorities. Some of them suggest taxing the motorist to pay for the upkeep of the roads; and one enlightened member of a certain corporation proposed to tax all motors £10 per annum per horse power. A little sum in proportion will, I think, speak volumes for the enlightenment of the age in regard to municipal affairs.

No doubt there is a real cause of grievance against motors; and some of our local authorities—probably urged on by the Automobile Club—are tackling the difficulty in such a manner that a solution is bound to be arrived at very soon. Several surveyors are busy experimenting with tar in various ways, of which I will briefly indicate two. First, where a road is to be re-made, the macadam is mixed with hot tar and laid in the usual way. This makes a good substantial and lasting road, costing, I believe, about one-third more, but lasting considerably longer, than the old plan. Owing to the viscous property of the tar, disintegration is conspicuous by its absence, and therefore there is no dust and consequently no mud; and a large amount is saved in watering and scavenging. The other method is applicable to roads already made. The process is to sweep the dust off the road, and apply the tar by sprinkling it, or by merely painting it on, and brushing it well into the road. I understand two coats will last twelve months; and the cost of the application is about 1d. per square yard. I have no actual experience of the painting of roads; but I have seen roads made of tarred macadam, and was much struck by the solid and clean appearance of the surface.

It will be clearly seen that if this tarring of roads becomes general, it will mean that a very large quantity of tar will be taken off the market; and it therefore behoves us to do everything in our power to foster this industry. To this end the Fermoy Gas Company have offered to each of any six Irish County Surveyors 1000 gallons of tar free, on their undertaking to experiment with it on road improvement. I think this is the spirit in which this subject should be dealt with; and when we are asked to supply tar, we should quote it at a price which, while giving us a profit, would enable the work to be carried on as cheaply as possible.

I have no doubt there are other methods of disposing of tar than those mentioned by me. It is an open question whether or not it would pay us to manufacture for sale asphalte ready for use. I think it would pay us well. I may mention, in conclusion, that tar is not worth 1d. per gallon to us as fuel; and bearing this in mind, we should be able to create a demand for it.

Discussion.

Mr. J. RICHMOND (Kilkenny) thought the disposal of tar was many a gas manager's bugbear. In past times, he had known cases in which, where storage was small, the tar was run into rivers, and even into gasholder tanks; and in the latter case the holders never required painting. He had in former years been successful in burning tar in direct-fired settings; but he had not succeeded with gaseous-fired settings. He did not look forward to the general adoption for some years of tar for road-spraying; and he thought asphalte for roads would not stand the traffic. He strongly advocated a co-operative movement among the different gas undertakings for the formation of central works for the distillation of tar.

Mr. APTED (Carrick-on-Suir) thought it a good thing to offer tar free, or at very low prices, to induce local authorities to use it on roads.

Mr. G. W. NORMAN (Dublin) was of opinion that concrete was more in favour than asphalte for footpaths.

Mr. J. GRANT (Tipperary) said burning tar in gaseous settings should not present insuperable difficulties. He had no trouble in disposing of his tar at a remunerative rate.

Mr. J. PATERSON (Queenstown) remarked that when once the difficulty of gasifying the tar was overcome, the problem of the use of tar as fuel in gaseous settings was solved. He preferred felt to galvanized roofs, and was of opinion that the quality of galvanized iron had deteriorated in recent years. He considered there was a great future for the use of tar for road-spraying, which was now beyond the experimental stage. It was the right thing to foster the use of tar for all purposes locally. He wished to learn from Mr. Tooms what was the saving of coke effected. He advocated gas companies getting metalling, and preparing and laying asphalte for roads and footpaths at an all-inclusive charge; and, if necessary, they should maintain the roads for a period.

Mr. J. G. TOOMS (Waterford) thought the paper a useful one, and wished to know from the author how he put the tar into his settings. With regard to having a co-operative tar distillery, he considered it would be necessary for the owners of gas-works to make a present of their tar to the distillery, carriage paid, and even then he thought the concern could not be profitable. He should like to ask Mr. Tooms what was the equivalent value in weight of coke of 100 gallons of tar for fuel purposes.

The CHAIRMAN, in calling upon the author to reply to the discussion, referred to road-making in New York, where he said bitumen was used instead of gas tar, and it made a really first-class substantial road. He thought there was no use in selling tar at 1d. per gallon; it would be better to burn it.

Mr. TOOMS, in reply, said some of the members seemed to confuse tarred macadam with asphalte roads. There was a difference between them. The tarred macadam being the ordinary road metal mixed with tar and asphalte, roads were made the same as footpaths; the only difference being that the road asphalte was of a more substantial nature. He thought asphalte footpaths were getting out of favour, owing to inferior workmanship, as, when properly made, they were very satisfactory at only about half the cost of concrete footpaths; and it was an exceedingly simple matter to reinstate asphalte footpaths after opening them for services, &c. Further, he said he had no doubt the gas manager was often to blame by charging as much as the customer would pay, instead of fostering the use of tar by low prices. He intended to make the footpath mentioned in his paper of gravel, as he agreed with some of the speakers that it was much more economical in tar than coke breeze, which soaked up a great deal of tar. He was afraid tar-works, even under associated management, would be a failure in the case of the South of Ireland; for 200,000 gallons of tar per annum would not be sufficient to warrant the expense of the plant. His idea in experimenting with burning tar in his external producer was that he wished to be prepared for an emergency—if he was at any future time unable to dispose of his surplus tar. He was sorry he could not give the members any definite figures as to his results. In bringing his paper before them, he hoped the discussion might prove helpful to him in his further work on the problem. While appreciating the difficulties mentioned by some of the speakers, he was very optimistic as to the ultimate result. His method of introducing the tar into the producer was to have a 400-gallon cistern, fixed on top of the bench, kept filled; thus maintaining the tar at a fairly uniform temperature. The tar ran through a ¾-inch pipe fitted with a cock, the outlet of which was reduced to ⅜-inch brass

pipe, which was coiled. The cock being turned full on, the length of brass pipe was such as to enable the friction to reduce the flow of tar to what was required—thus obviating the frequent choking of the cock, which was a source of annoyance. The tar fell from the brass tube with a funnel through a trap into the top of the furnace, sending the tar into the centre of it.

Mr. APTED (Carrick-on-Suir) read a paper on

DEVELOPMENTS IN THE CARRICK-ON-SUIR GAS-WORKS.

The subject of my paper—for which I ask your indulgence, as it is my first attempt at writing one—is the working of the Carrick-on-Suir Gas-Works during the past twelve months, and on the construction of a gasholder tank.

When I went to Carrick some fourteen months ago, I was told (as I think others were told before me) that Carrick had come to a stop—that is to say, that everyone who would take gas already had it, and that all I had to do was to look out and keep what consumers there were. I made up my mind not only to keep them, but to get more if possible; and the results, after twelve months' work, were that I put on between 60 and 70 new consumers, and fixed in all about 80 new cookers. This meant an increase in consumption of nearly 500,000 cubic feet in the year compared with the preceding twelve months, after making up for the supply to a large gas-engine that was lost owing to a suction plant having been installed. I think you will agree with me that this is very good for Carrick.

For a long time more storage capacity has been needed; it being only 11,000 cubic feet, with a consumption in winter of 28,000 cubic feet in 24 hours. Consequently we had to lose no time in erecting another holder; and this I hope to see finished within a few weeks. We built the tank ourselves; and I will give you a short description of the way in which it was done.

In the first place, we erected our trammel, it being put on a piece of timber about 14 feet long and 8 inches square, morticed into four flat feet at bottom and strutted. This we let into the ground about 8 feet, and it was rammed perfectly vertical. The trammel was made of a plank 11 in. by 3 in., and 21 feet long, and on to it was fixed a sliding scale about 4 feet long, a plumb-bob, and a line running over the nose. This being done, we started excavating to a depth of 13 ft. 6 in., with about 3½ moulds. When this was out, we put in footings 12 inches thick for that piece, and continued this all round; getting in footings as we went, till we came to where the inlet and outlet pipes were coming in. Here we sunk to a depth of 14 ft. 6 in., but only put in the same footings. Then we had the inlet and outlet pipes in position, we put footings around them, and brought these up to the proper level again. The ground I had to excavate was "made up" ground for a depth of 5 feet, and therefore it would not stand. Not wishing to excavate wider, to use outside moulds underground, I bought a lot of thin rough boards, and strutted with these about every 2 or 3 feet. After putting in the walls, I left these boards in, as it would not pay to take them out; and they have already paid for themselves in labour saved. I may mention that the excavation made was 4 feet wide; the wall being 1 ft. 6 in. wide, and the inside moulds only 9 inches. This left 1 ft. 9 in. for the men to work in and handle the moulds, which I found to be ample.

The next thing was to start the walls. I may say that everything was mixed 7 to 1—*i.e.*, 7 parts of clean gravel, large and small, mixed with 1 part of cement. In these walls I also put 3000 feet of 1½ in. by $\frac{1}{16}$ in. steel hoop. At every 4 inches up to a height of about 6 feet, I placed three strands of this hoop together, standing it on edge—first taking it nearer to the back of the wall, and next to the front—the ends of the hoops always breaking joint. The ends were bent over about 2 inches, and hooked together—not hammered flat, but filled with fine concrete. After getting up about 6 feet, I increased the distance to 6 inches apart, and used two strands instead of three. On the top of each lot of moulds, after putting in concrete, and of course while still unset, I placed large ragged stones which had been well washed, about 6 inches apart, and inclined—thus giving a better bond for the next lot of concrete. This was continued all the way up. As there are to be six standards for the gasholder, I had to fix six washer-plates, each 12 inches square, and with bolts about 3 ft. 6 in. long and $1\frac{3}{8}$ inches thick. These I enclosed in 2½-inch flue-pipe, so as to be able to move them about after the wall was finished. I think fixing these plates was one of the most difficult parts of the job, as they had to be exactly the same distance apart, and all level. I got over this by using a template.

Now that the walls were finished, the next thing was to take the centre out. I left in a dumpling filling from 3 feet in the centre to nothing on the foundations. I think it would be much better if we could arrange to have the ground we leave in flat on top, and use moulds, and get a wall up round to the same height, as it is a great trouble to get concrete to stop on a dumpling when oval until it is set. While doing this job, I came across some large stones, some weighing several hundredweight, which I need not tell you would have taken a very long time to raise a distance of 10 or 12 feet. Therefore, as a sledge-hammer would not break them, I had holes dug in the dumpling, and rolled them into them. The earth we removed was soon thrown out; and this saved a good deal of time. The dumpling was covered with 12 inches of concrete, the same as the foundation.

The next thing was to arrange the landing-blocks, of which I put in twelve, 2 ft. by 1 ft. by 3 in. thick. Six of these I faced with iron 5 in. by 3 in.; and for the other six I simply put in a block of timber 5 in. by 3 in., which will be cut for the tank and guides. I then made and erected the trestle which will support the crown of the holder when empty. This consisted of four legs, which I bedded in blocks of concrete 12 inches square. The inlet and outlet pipes are held upright and firm by collars round two of them, and by one angle-iron and two tie-rods; the bolts, of course, being bedded into the dumpling. The pipes are about 2 ft. 6 in. apart; the inlet being a 6-inch, and the outlet an 8-inch pipe. The next thing was to have the tank plastered inside, or "rendered," as it is generally termed. I had this rendering put on ¾-inch thick of equal parts of cement and sand, and had it trowelled to a glass-like surface. It was put on in two coats. The top and outside of the tank which is exposed for 2 feet down, and which will answer the purpose of a guard-rail, is finished off with a float; and the outside edge has a bull-nose finish.

The last job was to fill the tank with water and test it for staunchness. I filled it with water in about a week (by contract) for £4, with two men and two pumps; and after three weeks' test, with levelled straight-edge and rule, we only lost 1¼ inches, and I am certain all this would be taken by absorption and evaporation. Therefore I think you will agree with me that we have a good staunch tank 33 ft. 6 in. diameter and 12 ft. 3 in. from the top of the landing-blocks, the total cost of which was £244 6s. 11d., made up as follows:—

Timber, moulds, barrows	£10	1	1
Ironwork, pipes, valves, connections, flue-pipes	42	3	0
Hoop iron	10	0	0
Cement	44	11	9
Gravel	18	15	10
Labour	141	5	3
Depreciation of tools	2	10	0
	£269	6	11
Stones, moulds, and timber after job	25	0	0
Total	£244	6	11

Mr. RICHMOND complimented the author on his success in increasing the consumption of gas; for 60 extra consumers and 80 cookers he considered very good business in a town the size of Carrick. With regard to gasholder tank construction, he did not believe in leaving in a dumpling, as it did not add strength to the tank, and took extra covering with concrete, which was not recompensed in a small tank by the labour saved in not removing the dumpling. He mentioned that he had built a tank 55 ft. 6 in. diameter and 14 ft. 6 in. deep for £443.

The CHAIRMAN said he had built a small tank 27 ft. by 10 ft. for £78. The foundation was of stiff yellow clay. He excavated this, and faced the inside with 4½-inch brick stretchers, used every three or four courses, and filled in concrete between the brick and the clay. The price mentioned was exclusive of connections, &c. The only skilled labour employed was that of the bricklayer—his ordinary men doing the excavating and concreting in their slack time. He thought Mr. Apted's paper an admirable one, and a good specification for anyone who was about to build a tank.

Owing to want of time, the discussion on the paper had to be curtailed.

Mr. APTED having briefly replied,

Votes of thanks to the Chairman and to the readers of the papers were passed, and the proceedings closed.

Prize Winners in the Examinations in "Gas Manufacture."

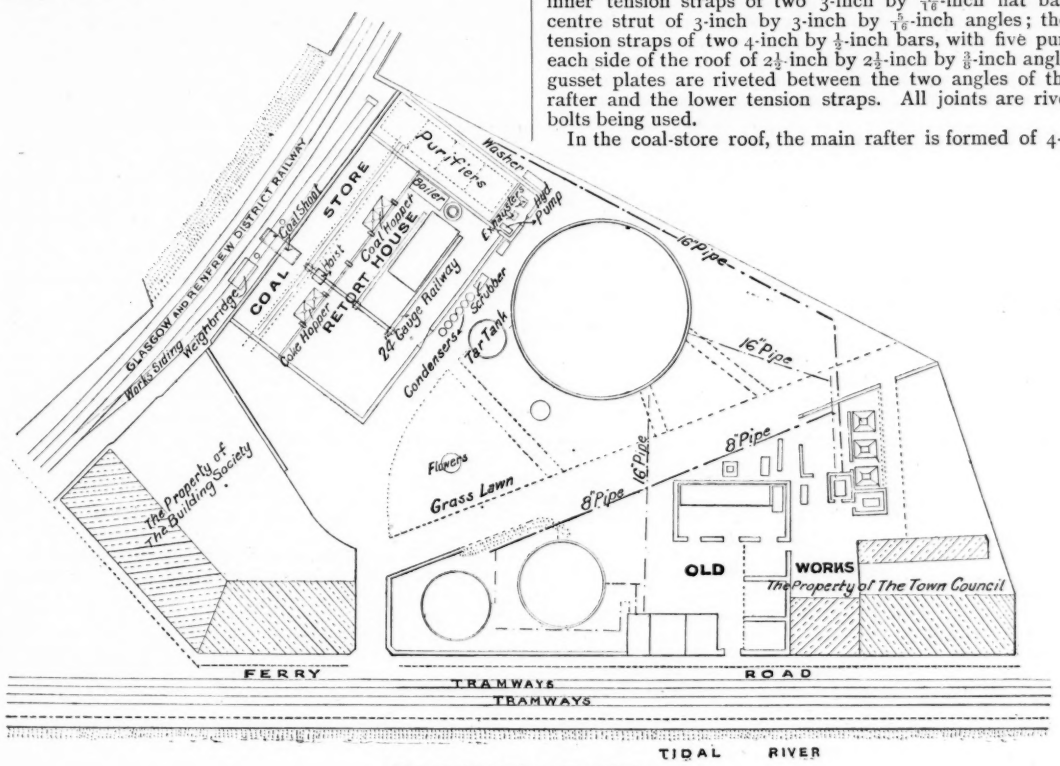
The names of prize winners in the last examinations by the City and Guilds of London Institute in "Gas Manufacture" have been published. They are as follows: Honours grade, first prize (£2 and a silver medal), Mr. George T. Purves; second prize (£2 and a bronze medal), Mr. Ernest F. Jones. Ordinary grade, first prize (£1 and a silver medal), Mr. A. E. Williams; second prize (£1 and a bronze medal), Mr. S. Carter; third prize (a bronze medal), Mr. C. F. Tooby. Mr. Purves studied at the Glasgow and West of Scotland Technical College; Mr. Jones and Mr. Williams, at the Regent Street Polytechnic; and Mr. Carter and Mr. Tooby at the Liverpool and Birmingham Municipal Technical Schools respectively. We have received from Mr. Walter Grafton, who conducts the classes at the Polytechnic, the names of the prize winners in the examinations held there. They are as follows: Honours grade, first prize (silver medal), Mr. W. H. Topley; second prize (10s.), Mr. P. S. Wilkins; third prize (5s.), Mr. E. L. M'Grath. Ordinary grade, first prize (bronze medal), Mr. Joseph Hewett; second prize (10s.), Mr. A. E. Williams; third prize (5s.), Mr. A. H. Meade. In addition to the prize, each Polytechnic student had a certificate. It will be noticed that Mr. Williams obtained the first prize in the ordinary grade in the City and Guilds examination; and it must be highly gratifying to Mr. Grafton to find that only three of his students failed. We congratulate all these young men upon their success.

NOTES ON CONSTRUCTION OF NEW WORKS.

By Thomas Lighbody, of Renfrew.

[**A Paper read before the North British Association of Gas Managers, at Edinburgh, July 26.**]

During the past ten years, the increase in the quantity of gas manufactured in Renfrew has amounted to 280 per cent. To keep pace with this increase has not been the least of our difficulties. In the year 1898, the Council acquired additional ground close to the works, and erected a holder thereon. At that time no thought was taken of putting up new works on the additional ground. But in 1900, when the Glasgow amd Renfrew District Railway passed the boundary, the Council and the Railway Company agreed to build a retaining wall along the boundary, 180 feet long; so that if at any time it was necessary to build, the ground there placed us in a very good position to get facilities for the discharging of coal, &c.



Plan of the Renfrew Gas-Works,

Early in the winter of 1903-4, it became imperative to consider the extension of the works. I received instructions to prepare plans showing what could be done in extending the old works, and also in building entirely new works alongside the railway. On having these plans submitted, the Council called in Mr. Gillespie to report and advise them as to which was best. He advised the Council that it would be better to build new works. I quote from his report as follows: "Plan No. 1. In my opinion this plan has been very well considered and carefully worked out. The use that is made of the railway facilities now existing is admirable, and would put your works in line with the best modern practice. The natural arrangement of having the coal-store alongside the high-level railway siding has been followed; the retort-house being on the side of the coal-store farther from the railway."

On the Council deciding to carry out this scheme, the first difficulty to be overcome was the objections of the coterminous proprietors. These were ultimately overcome on payment of a sum agreed upon. The main consideration in this scheme was the siding; and the whole works were arranged to get the full advantage therefrom.

Alongside the retaining wall [see plan] is a coal-store, 130 feet long, with a clear span of 34 ft. 5 in., and a retort-house 130 feet long having a clear span of 59 feet. At right angles, on the end, is the purifier-shed and lime-store, having at the end the engine-house on the ground floor and the men's mess-room and the test-room above. All these buildings are 27 feet high to the eaves, and are built of pressed composition brick inside, faced with a red pressed facing brick on the outside—all set in cement mortar. The whole of the buildings (including the foundations, drains, chimney, and foundations for the condensers and scrubbers, leaving and making good on completion all holes for other tradesmen) cost the sum of £1358 8s. 4d.

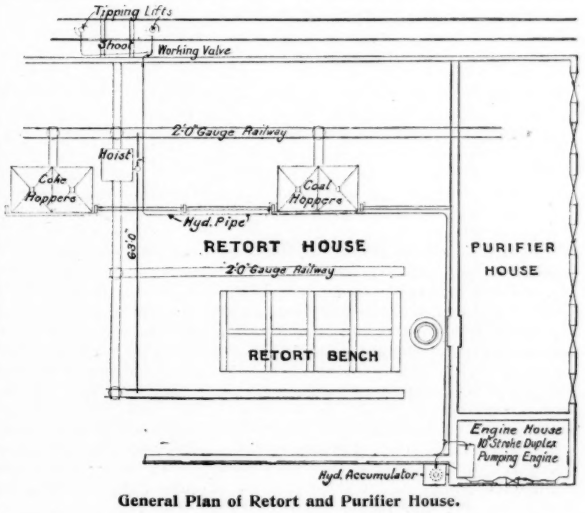
The details may be of more value—local circumstances considered:

Excavations for foundations, per cubic yard					1s. 6d.
Concrete	,,	,,	,,		—
,,	of broken brick		,,		15 6
,,	,,	whin metal	,,		16 6
27-inch brickwork, per square yard					10 6
22½-inch	,,	,,	,,		8 9
18-inch	,,	,,	,,		7 0
14-inch	,,	,,	,,		5 3
9-inch	,,	,,	,,		4 0

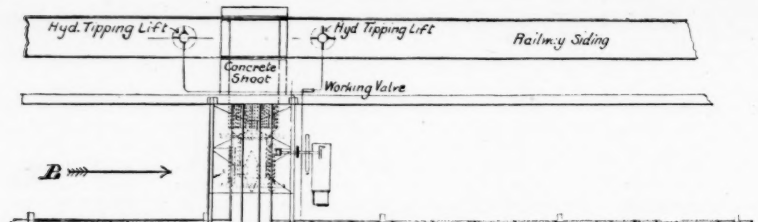
All the roofs are covered with corrugated iron, and are designed accordingly. The steel specified was of British manufacture, made by the Siemens-Martin open-hearth process. The main rafters on the coal-store and retort-house are set at 10 ft. 10 in. centres, and are built up as follows: Retort-house main rafters of two 4-inch by 3-inch by ½-inch angles placed back to back, having struts of, first 3-inch by 3-inch by $\frac{5}{16}$-inch angles; second, 3-inch by 3-inch by ½-inch angles; third, 3-inch by 3-inch by $\frac{5}{16}$-inch angles. There are tension straps of 3-inch by $\frac{7}{16}$-inch flats; the inner tension straps of two 3-inch by $\frac{7}{16}$-inch flat bars; the centre strut of 3-inch by 3-inch by $\frac{5}{16}$-inch angles; the lower tension straps of two 4-inch by ½-inch bars, with five purlins on each side of the roof of 2½-inch by 2½-inch by ⅜-inch angles. All gusset plates are riveted between the two angles of the main rafter and the lower tension straps. All joints are riveted, no bolts being used.

In the coal-store roof, the main rafter is formed of 4-inch by 3-inch by $\frac{7}{16}$-inch T-section, the side struts of 3-inch by 3-inch by $\frac{7}{16}$-inch angles, with vertical straps of 2¼-inch by $\frac{7}{16}$-inch flats; the lower tension bars of two 2¼-inch by $\frac{7}{16}$-inch flat bars, with three portions on each side of the roof of 2½-inch by 2½-inch by $\frac{7}{16}$-inch angles. All joints are riveted, no bolts being used.

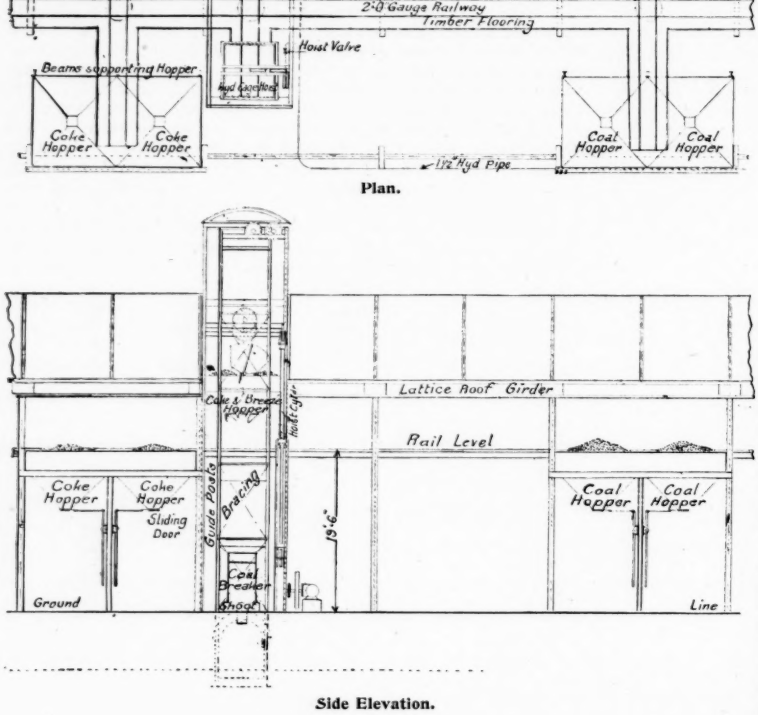
The lime-store roof has a clear span of 28 feet 6 inches. The principals are set at 10 ft. 6 in. centres, and formed of 4-inch



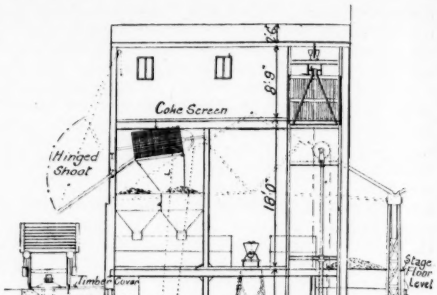
General Plan of Retort and Purifier House.



Plan.



Side Elevation.



End Elevation, Looking along Arrow B.

by 3-inch by $\frac{7}{16}$-inch T-sections, having vertical struts of 2½-inch by 2½-inch by $\frac{7}{16}$-inch angles, diagonal tension bars of 2½-inch by $\frac{7}{16}$-inch flat bars, the lower tension bar of 2½-inch by $\frac{7}{16}$-inch flat bar. Three purlins on each side of the roof are 2½-inch by 2½-inch by ⅜-inch.

All the sheeting is of No. 18 B.W.G., galvanized and corrugated. At the centre, between the coal-store and the retort-house, are erected five standards of 21'8 inch centres. These standards are 27 feet high and built up of two 4-inch by 4-inch by ½-inch angles, on each side, backed by one 9-inch by ⅜-inch flat, riveted on with ¾-inch rivets at 6-inch centres and intersected by straps of 3½-inch by ½-inch flat bars between the angles; plates being fixed where the girders join, while the beams are fixed for supporting the stage floor. The girders are formed at the top and ends of two 4-inch by 4-inch by ½-inch angles, with plate of 8½-inch by ⅜-inch riveted on the top at 6-inch centres. The bottom is formed of two 3½-inch by 3½-inch by ½-inch angles, having plates on either side, and the centre and straps of 3½-inch by ½-inch flat bars—the two end girders being longer, and built into gables.

The following are the prices per square yard of the area covered (including gutters, conductors, and ridges), erected complete:—

Retort-house roof, per square yard of area covered				.	10s. 1d.
Coal store	,,	,,	,,	,,	. 8 9
Purifier house	,,	,,	,,	,,	. 7 1

The standards, girders, and 12-inch beams cost £142 6s. All the ironwork received two coats of paint, one before and one after erection.

The retort-bench is on the stage-floor plan. It is 44 ft. 1½ in. long and 23 ft. 11 in. wide under the stage and 19 ft. 6 in. above it. The height to the stage is 9 feet; above the stage the height is 10 ft. 7 in. The bench consists of four segmental arches, 8 ft. 9 in. wide; the division walls are 22½ inches thick under the stage and 18 inches thick above the stage. The abutments at the ends are 2 ft. 6 in. thick below the stage and 2 ft. 3 in. above. The materials used in construction were fire-bricks from the Bonnybridge district; the top of the bench, red bricks; the arches, three rings of 4½-inch first-class fire-brick. The arches are formed through the retorts (singles) having an independent 9-inch wall between the ends. This arrangement is made to allow of through retorts being put in at any time, without causing any breaking of the arches. The main flue is double, one for each side. The retorts are set on the full-depth regenerator principle, having very large producers, so constructed that from the feeding and cleaning doors any part can be easily got at for cleaning. The producers are fitted with steam and water, and have given excellent results. To counteract any danger from settling, the foundations are arched under the centre of the ovens. The concrete is composed of four parts of broken whin metal, two parts of sand, and one part of Portland cement. For foundations such as this, I prefer this to broken brick. The same concrete is used for the chimney, and is 15 feet square and 3 ft. 6 in. deep. The chimney is built of pressed red brick, 70 feet high, and is lined with 4½-inch fire-bricks to a height of 25 feet, an air-space being left between the red brick and the lining.

The ironwork does not embrace any special feature. The bench is bound at the ends by four 12-inch by 6-inch heavy H-section binders, tied together by rods of 2 inches diameter. The front binders, under the stage floor, are of 10-inch by 6-inch heavy H-section; above the stage the front binders are built of two 6-inch by 5-inch H-section—all carefully fitted and bolted together and inserted 15 inches into the concrete foundations. Each oven is served by a separate hydraulic main, having an 8-inch gas and a 4-inch tar offtake pipe.

The stage floor is formed of ten main girders of 12-inch by 6-inch H-section joists, and one end resting on the abutment of the bench and the other end on codding in the wall. The binders under and above the stage are securely bolted to these. The longitudinal joists are of 8-inch and 5-inch H-section. Three bays are filled in with breeze concrete, faced with 1½ inches of granolithic. One bay has cast-iron plates, with openings to the coke-hoppers.

The cost per retort, worked out on finished prices, is as follows:—

	£	s.	d.
Foundations	1	7	6
Bench	6	9	8
Filling ovens	8	8	9
Ironwork	15	12	6
Stage floor	2	11	10
Total per retort	34	10	3

The boiler is a Lancashire, 20 feet by 6 feet, and is set under the stage on the coal-store side of the chimney. All the steam-pipes are of steel; the working pressure being 85 lbs.

The condensers are of the annular type, with six tubes; the outer tube 36-inch diameter, the inner tube 28-inch, having cast-iron base-plates fitted with 16-inch inlet and outlet. There are valves and connections, overflow pipes and seal-pots, cleaning doors, &c., with 16-inch connections to the engine-house.

There are two rotary exhausters and engines combined, each to pass 25,000 cubic feet per hour at 80 revolutions. These have all connections inside the house, including gauges, regulators, &c.

There are four purifiers in one continuous box, with divisions to form four separate purifiers, 20 feet square and 5 feet deep to the top of the flanges of the bottom plates. The plates are ⅜-inch thick. All the flanges are machined. The covers are formed of 6-inch by 4-inch angles; the sheeting of $\frac{3}{16}$-inch plate strengthened by four tees 6-inch by 4½-inch, also 4-inch by 3-inch angles inside, at the lifting-hooks. The covers are jointed by rolled rubber, this being of square section, with a recess for steel strip for bolting on to the cover. The purifiers are worked by Weck valves and 16-inch connections throughout, and are supported on girders of 14-inch by 6-inch H-section, fixed at either end in the walls, having a column in the centre—the position being such as to compel this method of having the space below for waste material and the lime and oxide floor above. The lime and oxide floor above the purifiers is formed of 18-inch X-beams, built into the walls at both ends. Secondary beams are placed between, of 6-inch by 5-inch section, and filled with arched breeze concrete. The whole forms

a very convenient arrangement, and allows of the purifiers being filled from above and emptied through the bottom. The cost of the complete installation was: Purifiers, £1441; staging and concrete floor, £172—total, £1613. The floor, including beams and concrete, cost 9s. 6d. per square yard.

The railway siding being on the high level, and the bench on the stage-floor plan, some special method of handling the material had to be settled. After some consideration, the following plan was adopted: The waggons, on being received, are weighed, and tipped by a hydraulic ram (two being provided so as to catch the waggons at either end as required) into a shoot, which extends through and under the siding, and into an iron hopper inside the coal-store. Above the hopper, the coals are broken in passing through the breaker, and are caught in a hopper with sliding door, from which they are dropped into a side-tipping truck with a capacity of 10 cwt., which runs on a 24-inch gauge railway in the underground tunnel. The truck is run on to a hydraulic hoist, and raised to the elevated portion of the railway, from which it is emptied into bins for the stokers or into store as required. In the hopper above the breaker there is fixed a grating through which all (or nearly all) coal less than 4-inch passes direct to the bottom hopper, so that when nuts are being handled the breaker is not required. From the underground tunnel, the coals can be removed from any part of the store through a series of shoots. The coke as it is drawn from the retorts drops direct into a box fitted with a movable bottom, in which a spray of water is playing while the stoker is drawing. This box is large enough to hold one charge. On the bottom being drawn to one side, the contents drop into a side-tipping truck, which is large enough to hold three charges, and is easily removed and taken up the hoist and tipped on top of the coke heap, or screened direct into a truck on the railway siding or into a hopper, from which it is drawn for cart sales.

The coal and coke handling plant, which will be easily understood from the drawings, consists of two hydraulic rams in the siding, a coal breaker and engine (by arrangement of clutch gear the one engine drives the breaker and coke screen), the hoist, 190 feet of elevated 24-inch gauge railway, erected on tressle work of 8-inch by 5-inch H-section and bracings, two double hoppers, one for coal and one for coke, a hopper divided into three compartments under the coke-screen, one each for coke, breeze, and dust, with suitable duplex hydraulic pumping-engine and accumulator, two tipping lifts, all steam, hydraulic, and return water pipes, &c. The following is the cost:—

Coal and coke plant	£1694	9	1
Underground tunnel	118	15	0

During the year ended May 15, the quantity of coal carbonized was 5188 tons, and the total wages paid for all labour inside the gas-works—which includes stoking, emptying and storing coal, screening coke, handling lime, purification, attention to boiler, engines, and machinery—was £572 12s. 1d., or 2s. 2·48d. per ton. A separate account was kept, and it is as follows:—

Carbonizing	£476	1	6
Purification	20	17	6
Emptying, breaking, and storing coals	75	13	1

Separating the costs for coal and coke, they are as follows:—

Coals	£27	0	5	or 1·25d. per ton.
Coke	47	13	4	,, 5·50 ,,
Lime and oxide	0	19	4	,, 4·50 ,,

Comparing these figures, I find the previous year's charges were as follows:—

Carbonizing	£631	5	0
Purification	46	3	0
Storing coal and loading coke	85	12	0
Cartage and weighing, 4926 tons coal, at 7d.	143	13	0
,, ,, 100 ,, lime ,, 1s.	5	0	0
,, of tar, 1250 tons, at 1s.	62	10	0
,, of coke, 1400 tons, at 10d.	58	6	8
Total cost	£1032	9	8

Or 4s. 2·12d. per ton of coals. Thus the new plant has effected a saving of 1s. 11·64d. per ton on 5188 tons, or equal to £511 0s. 4d. The plant is quite capable of breaking 7 tons of coal per hour, or handling 10 tons of nuts per hour. As there is nothing to create excessive tear or wear, this charge for twelve months has been only £9 5s.

COMETS IN THE GAS INDUSTRY.

By "An Observer."

No. 4.—Self-Purification of Gas.

Another idea that has attracted a great deal of attention at times, has been the subject of practical experiment, and has even offered considerable prospects of success, is self-contained purification of gas by means of its own constituents, without the aid of lime, oxide, or any other extraneous substance. But yet one finds that gas is being purified to-day on much the same lines as those adopted at the commencement. It is still washed, scrubbed, and passed through dry purifiers. The introduction of oxide of iron, as either entirely or to some extent displacing lime, is the only radical improvement; although, of course, many advances in details connected with washers and scrubbers have been effected from time to time. But apart from these, we may say that gas is now purified as it was in the days of Murdoch. Theoretically, it may be wasteful and wrong to employ additional or outside purifying agents, in the same sense that it is barbarous to burn tar and dissipate its valuable constituents in smoke. But as a matter of business it pays to do so; and the present methods are so simple, reliable, and cheap, that they require a lot to beat them, even if the material is provided *gratis*.

The first great obstacle in the way of self-contained purification is the fact that the statement—like many others that find general credence—is not an entire presentment of the truth. The assumption is that the volatile alkali, or ammonia, can be made to combine with the acid impurities (carbonic acid and sulphuretted hydrogen), forming soluble salts that can readily be dissolved out by water. If the crude gas as it leaves the retorts, contained sufficient alkali for this purpose, the problem would be greatly simplified. But it does not contain more than one-fourth to one-eight of the requirement; and this at once brings in a large order. In addition to the purifying apparatus proper, there must be a revivification plant of four to eight times the capacity, to provide sufficient "free" alkali; and every particle of the alkali produced must be turned over four to eight times. So, before going very far into the question, it is evident that the self-contained process not only calls for considerable additions to existing scrubbers and washers, but an elaborate system of apparatus, storage tanks, pumps, &c., in connection with secondary operations. When these points are properly appreciated, and the additional apparatus is compared with the complete equipment of dry purifiers, lime shed, and oxide shed, it is obvious that there is no advantage in the introduction of any elaborate processes, which even skilled chemists cannot always keep under proper control. The purifying process must above all things be steady and reliable; well in harness; and not liable to kick over the traces.

The purification of gas presents several different features from ordinary chemical operations. It is one thing to prepare a stock of solid or liquid crude products, and purify them at convenience, and quite another thing to deal with a gas that must be treated in transit from the retort to the holder; that is not only extremely bulky, but also has to be brought to a degree of purity far beyond what is usual in regard to other products. The impurity remaining in coal gas as prepared for distribution, is stated in small fractions per cent. So that no gas engineer would take the responsibility of working any liquid process—self-contained or otherwise—without the precaution of a dry purifier of generous proportions, for use as a catch-box.

Probably, the use of an entire liquid purifying process would not be regarded as an insuperable objection now, though at one time there was considerable feeling against excessive washing or scrubbing, and some gas engineers objected to cold water, on behalf of the gas, as strongly as any tramp or street arab could resent its application to his own person. It was supposed to depreciate illuminating power, to aggravate the formation of naphthalene, and to conduce to stoppages. But the foundation of these ideas was bad or insufficient condensation. No doubt, it is a mistake to douche hot gas with water at an appreciably lower temperature, or to regard the washers and scrubbers as tar extractors; as if the gas is subjected to sudden changes of temperature or to intimate contact with cold tar, trouble is sure to follow. The proper function of washers and scrubbers is that of purifiers wherein liquids are applied for the absorption of such impurities as can be removed by these means. If the gas has previously been reduced to atmospheric temperatures, and freed from suspended matters, the liquid used is also at atmospheric temperature, and both it and the apparatus reasonably free from tar, no harm can ensue from a liberal liquid treatment. At present, the objections to liquids are of a practical character rather than theoretical.

Damage to Roads by Heavy Traffic.—In the course of the evidence given before the Royal Commission on Motor Cars, attention was directed by representatives of the Association of Municipal Corporations, of the conference of the Metropolitan Borough Councils, and of the Gaslight and Coke Company, to the excessive weights put upon roads in cities and large towns, and to the resulting damage to the roads themselves, as well as in some cases to the various pipes and mains beneath. The instances brought under the notice of the Commissioners were sufficient to convince them of the increasing necessity, even under existing conditions, of making main roads more capable of carrying heavy motor-car traffic than they are at present.

Reduction in Price at Bristol.—The Directors of the Bristol Gas Company intimate that, from the commencement of the current quarter, the price of gas in the area of the Company's supply, both within and outside the borough, will be as follows: To consumers of under 500,000 cubic feet per annum, 2s. per 1000 cubic feet; to consumers of 500,000 cubic feet and upwards per annum (Jan. 1 to Dec. 31), if used on one premises, 1s. 6d. For the current half year the latter price will be charged if a proportionate quantity of gas is consumed. For gas used for motive power only, irrespective of quantity, the price will be 1s. 6d. The Chairman (Alderman J. W. S. Dix, J.P.) and Directors of the Company are to be congratulated on the sound and progressive policy evidenced by this important reduction to large consumers and power users.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Gas Prohibited by an Electric Lighting Agreement.

SIR,—I have just seen a form of agreement issued by the County of London Electric Supply Company for signature by a consumer. After specifying the price—viz., 4½d. per unit—and the time, which is a minimum period of three years, subject to three months' notice thereafter, the following clause occurs: "Gas to be excluded for lighting purposes."

I do not know whether you may have heard anything like this, but it is new to me. It occurs to me that, unless the Electric Supply Company's Acts give them power to exclude a competitor—a statutory competitor, moreover—in this manner, the agreement, even if signed by the consumer, would be of doubtful legality, although the Company would no doubt contend that when signed the clause would be binding like any other in an agreement. What would be the position of a gas company who inserted in their agreements a clause: "Electricity to be excluded for lighting purposes"? Possibly some of your readers may be able to throw light on the subject.

DIRECTOR.

July 26, 1906.

Wild's Flicker Photometer.

SIR,—With reference to the article in your last issue, on a "New Flicker Photometer," said to be invented by Mr. Lancelot W. Wild, we beg to inform you that this is within the range of the patents of Simmance and Abady, whose Solicitors are communicating with Mr. Wild on the subject.

ALEX. WRIGHT AND CO., LTD.

Westminster Palace Gardens, S.W.
July 26, 1906.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported with amendments: Kingston-upon-Hull Corporation Bill, South Lincolnshire Water Bill, Sutton District Water Bill.

Bills read the third time and passed: Derby Gas Bill, Poole Corporation Water Bill, South Lincolnshire Water Bill, Todmorden Corporation Bill, Tottenham and Edmonton Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read the third time and passed: Crediton Lighting and Power Bill, Truro Gas Bill.

Lords Bills reported, with amendments: Gas Orders Confirmation Bills (Nos. 1 and 2), Gas and Water Orders Confirmation Bill, Great Yarmouth Water-Works and Lowestoft Water and Gas Bill [preamble not proved].

Control of Water Supply.

Last Wednesday, Mr. Donald Maclean, the Member for Bath, asked the President of the Local Government Board whether, in view of the aggregation of population in urban areas, and the development of industrial undertakings—both requiring, in the interests of public health and industrial efficiency, a great increase of the existing water supply—he would take into consideration the advisability of instituting an inquiry, either by Royal Commission or by Parliament, to investigate, among other things, the need for the protection and development of existing gathering-grounds and other sources of water supply, the allocation of such gathering-grounds and other sources on a comprehensive and equitable basis, and the general control and supervision of this subject of national importance by some central and properly qualified body or department. Mr. Burns, in reply, said the Royal Commission on Sewage Disposal in their third report made recommendations as to the establishment of a central authority, in connection with the Local Government Board, for the prevention of the pollution of water, and for some other purposes relating to water supply. They considered that the central authority might, with the aid of the Rivers Boards which they thought should be set up, collect information with regard to the waste of water and its abstraction from one district for distribution in another. He was giving attention to the report; and it seemed to him that, pending a decision on the recommendations contained in it, consideration of the desirability of an inquiry by Parliament, or by another Royal Commission such as was suggested by the honourable member, should be deferred. In a supplementary question, Mr. Maclean asked whether, in the consideration of the matter, regard would be had to the question of afforestation, which was so nearly related to an adequate water supply. Mr. Burns replied that in the event of such an inquiry as that indicated by the question being instituted, the question of afforestation might, in his judgment, clearly come within the reference to such a body.

GAS AND WATER ORDERS CONFIRMATION BILLS.

The Unopposed Bills Committee of the House of Commons, presided over by Mr. CALDWELL, had several Bills before them on Friday.

The Gas Orders Confirmation (No. 1) Bill, which seeks to confirm Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Charing, Chichester, Corsham, Farnham, and King's Lynn, was ordered to be reported. The Gas Orders Confirmation (No. 2) Bill proposes to confirm Provisional Orders made by the Board of Trade relating to Newport Pagnell, Pontardulais, Raunds, Redditch, and St. Austell. This was passed by the Committee, and ordered to be reported. A similar decision was given with reference to the Gas and Water Orders Confirmation Bill, which proposes to confirm Provisional Orders relating to Bolsover and District Water, Great Grimsby Gas, Great Grimsby Water, Hoylake and West Kirby Water, Wath-upon-Dearne and District Gas, and Wollaston Gas.

In all these measures the only amendment of importance was the insertion of the new model clause relating to the testing of gas.

LOCAL AUTHORITIES AND GAS AND WATER ORDERS.

The Board of Trade have presented to the House of Commons, under section 4 of the Gas and Water Works Facilities Act, 1870, reports setting forth their reasons for dispensing with the consents of certain Local Authorities in the cases of the Corsham Gas and Mid-Kent Water Provisional Orders.

Corsham Gas Order.

The application for this Order was made by the Corsham Gas Company, Limited, and was for power to maintain and continue existing gas-works and to supply gas in the Parishes of Corsham, Lacock, and Biddestone, in Wiltshire. The promoters were already supplying gas in Corsham, but desired to obtain statutory powers in respect of that place and of the two adjoining parishes named, in respect of which additional area the consents of the Parish Councils and of the Wilts County Council were duly produced. They failed, however, to obtain the consent of the Chippenham Rural District Council, and requested the Board of Trade to exercise the powers conferred upon them by the Act of 1870, and dispense with that consent. The Board accordingly held an inquiry at their office, and invited the attendance of all the authorities concerned. The Rural District Council, who had not lodged any objection against the Order, were not represented, and made no communication to the Board with reference to the inquiry. Representatives of the Corsham Parish Council attended in support of certain objections which they had made; and evidence in support of the Order was given by the promoters. In the circumstances, it did not appear to the Board that there was any ground for refusing to grant the promoters the statutory powers asked for; and therefore they decided to dispense with the consent of the Rural District Council, and grant the Order with such modifications and amendments as they considered necessary.

Mid-Kent Water Order.

In the case of this Order, the application was made by the Mid-Kent Water Company, and was for power to raise additional capital and extend their authorized area of supply. The promoters requested the Board of Trade to dispense with the consents of the Cranbrook and Elham Rural District Councils, and the Stelling, Stalisfield, and Upper Hardres Parish Councils; and the Board accordingly held an inquiry at their office, and invited, among others, representatives of these authorities to attend. None of them, however, with the exception of the Cranbrook Council, accepted the invitation. It appeared that as regards the parishes of Stalisfield and Upper Hardres, the District Councils concerned had given their consent, and were favourable to the application. As regards the parish of Stelling, neither the Parish Council nor the Elham Rural District Council had done so; but they did not lodge any objections, or make any representation to the Board of Trade, with regard to the inquiry. As to the Cranbrook Council, whose consent was required as the road authority in respect of the parish of Frittenden, the Parish Council had consented to the application; but the Rural Council lodged objections. From these it appeared that the Council desired that the exclusive right of supply in the parish of Frittenden should not be retained after two years (instead of six years as proposed in the Order) if the undertakers were not within this period providing a sufficient supply of water. The Council also desired to secure the insertion of a special clause with regard to the roads under their jurisdiction. The Board of Trade inserted a provision to give effect to the wishes of the Council on the first point, but were unable to see their way to require the promoters to accept the suggested clause with regard to roads. Evidence was furnished of the necessity for a supply of water in each of the parishes referred to; and, in the circumstances, the Board were of opinion that there were no sufficient grounds for refusing the promoters the statutory powers asked for. They therefore decided to grant the Order, subject to such modifications and amendments as they considered necessary.

SUTTON DISTRICT WATER BILL.

The Select Committee of the House of Lords, presided over by the Earl of KINTORE, had before them on Thursday the Sutton District Water Bill, which has for its object the preservation of the sources of water supply of the Sutton District Water Company, and for other purposes. There were several petitions in favour of the Bill, which was passed by a Commons Committee on the 4th inst. (*ante*, p. 119).

The Hon. J. D. FITZGERALD, K.C., Mr. BARNARD LAILEY, and Mr. H. F. BIDDER appeared for the promoters; while Mr. FREEMAN, K.C.,

Mr. MOON, K.C., and Mr. CLODE represented the London, Brighton, and South-Coast Railway Company, the only opponents, who still objected to the Bill.

Mr. FITZGERALD, addressing the Committee on behalf of the promoters, said the Railway Company were sinking a deep well not far from an existing one belonging to the promoters, and intended to use the water from it for their general purposes outside the district. If the Railway Company were in the position of a local authority or a landowner, they could not do what they were doing without the sanction of Parliament. The Railway Company were proposing to use electricity for the supply of certain lines, and if an experiment which was in contemplation was a success, no doubt the whole of their suburban lines would be worked by electricity; and he would point out that the quantity of water required for a generating station was enormous. He was sure that if the proposal of the petitioners were carried into effect, the River Wandle would be seriously affected.

Mr. FREEMAN (interposing) said it might simplify matters very much if he said that the Railway Company did not wish to take the water to London as had been suggested; they did not want it for a generating station; and, in fact, they did not desire to injure anybody's water supply. They would only use the water in the district for purposes connected with their railway; and they would only make use of a reasonable supply outside the area of the Company. He was quite prepared to come under any obligation that was reasonable.

Mr. FITZGERALD: My friend has omitted to state what is the quantity of the water that he wishes; and that is the whole essence of the question. If he is proposing a limited amount of water, I daresay it might not be necessary to do more than insert in the Bill any undertaking that he is prepared to give.

Mr. FREEMAN: I am prepared to limit the amount of water to 500,000 gallons. (Laughter.) I do not see anything funny about that.

Mr. FITZGERALD said he was afraid he could not accept that. He then called witnesses who supported his statements.

Mr. *W. Vaux Graham*, the Consulting Engineer to the promoters, said that the total capital of the Water Company was £334,252, and the estimated population 57,000, of whom the Company supplied 53,000. They had machinery which was capable of pumping from 2½ to 3 million gallons of water a day. The greatest quantity ever raised in a day was 2,548,000 gallons. Any water which could be pumped from the river in the neighbourhood should be the property of the Water Company.

Mr. FREEMAN then addressed the Committee on behalf of the Railway Company, and pointed out that, as there was no serious dispute with regard to the facts of the case, he did not propose to call any evidence. What the promoters were asking was absolutely without precedent in the whole history of Parliament. The Railway Company had a perfect right to sink a well on their own land, get water, and use it for any legitimate purpose they wished. They did not desire to be unreasonable, and the Water Company should show a like spirit. He suggested that the matter should be left to arbitration.

Mr. FITZGERALD said if there was to be any arbitration at all, it would be necessary to include the question of the effect of the well upon the Carshalton springs. He could not believe that his friend wished to go to arbitration on such a point as he had suggested.

The Committee decided that the Bill might proceed.

MID-KENT WATER ORDER.

A Water Orders Confirmation Bill which proposes to confirm certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Herne Bay, Maidstone, Mid-Kent, Ricmanshaw and Uxbridge Valley, Sleaford and District, and Slough, came before the Select Committee of the House of Commons on Friday, with Mr. TOULMIN as Chairman.

Mr. VESEY KNOX represented the promoters, and Mr. WEDDERBURN, K.C., appeared for the Cranbrook District Water Company, who opposed the Mid-Kent Order.

Mr. KNOX, in his opening speech, said that in the First House there was no opposition; but the measure was now being opposed at the last stage. The Mid-Kent Water Company—a statutory Company—were the promoters, and the area of supply was a large rural district. The population was 60,000; and of this number the Company supplied 59,000. They supplied 66 per cent. of the houses in the whole area. In some weeks, the supply was as much as 8 million gallons; but the average supply per day throughout the year was 1 million gallons. They had laid 183 miles of mains; and there was a storage capacity of 2½ million gallons. The capital which had been raised, including debentures, was £186,000. This had been profitably spent, because on their original 10 per cent. shares the Company paid 7½ per cent., and on the capital more recently raised 5 per cent.; while they were now able to raise their capital under the auction clauses at a very good premium. The profits for the last six months were £6300. It was with respect to the intention of the Company to supply three parishes—Biddenden, High Halden, and Frittenden—that the opposition was raised. These three parishes had enjoyed the advantage of being within the area of supply of one water company or another for seventeen years. By their Act of 1889, the South Kent Water Company were empowered to supply them with water; but they could not get either water or money, and failed to give a supply. Then the Cranbrook Water Company came to Parliament, and turned out the South Kent Company; but they had also failed to give a supply. Pipes, however, had been recently laid. In the interest of water consumers throughout the country, it would be a most unfortunate precedent if the Committee were to reject the Order. Should they do so, it would mean that any Company like the Cranbrook Company could get into a district to supply water, but could neglect to perform duties, and yet keep other people out of the district.

Mr. *F. L. Ball*, the Secretary of the Mid-Kent Water Company, gave evidence that they sought power to raise £40,000 of additional capital. The profits from the undertaking had been steadily increasing; and now they were paying 7½ per cent. on the original shares.

During the cross-examination of the witness by Mr. WEDDERBURN,

Mr. KNOX said that if the Committee would give the powers for which they asked, the Manager of the Company would furnish an undertaking to supply the three parishes in question in twelve months' time.

Mr. WEDDERBURN, at a later stage, said that the question of principle which was involved in the Order was so important that he did not wish to let the case go off on an undertaking. There had been no neglect whatever. The Cranbrook Company waited, no doubt, as had been done in every case, for a demand for water under the Water-Works Clauses Act.

The Chairman of the Mid-Kent Company was called and repeated his willingness to give the undertaking referred to.

Mr. WEDDERBURN, in addressing the Committee on behalf of the petitioners, said that the Cranbrook Company were already supplying water in Biddenden. They meant to be in High Holden in six months; but he was not in a position to give a pledge with regard to Frittenden. Parliament had to take a wider view of the matter, and ask what would be the effect upon the promotion of water companies in rural districts, if they were to allow such a principle. They would not get anybody in the rural districts of England to promote water companies. When the matter came before the Board of Trade, the Inspector, in giving his decision, said he desired to know whether or not it was within the power of the Board to make the Order.

Some discussion took place upon this; and it was finally decided to hear what the Board of Trade had to say in the matter.

A representative of the Board who was in the room told the Chairman, in answer to his questions, that when the Inspector gave his decision he remarked about taking legal advice on the matter. He granted the Order; but it was open to the Cranbrook Company to come to Parliament and oppose its confirmation.

The CHAIRMAN: Thus leaving it to the Committee to deal with it on its merits?

Witness: The whole question is left to the Committee.

The CHAIRMAN: But is there any special point in regard to this Order different to any other Order?—We have made the Order, but not subject to any reservation, and submitted it to Parliament. We do not suggest how you should deal with it.

Mr. WEDDERBURN: There is no precedent for this?—I am not aware of any.

Mr. KNOX: Was an opinion taken?—Yes; and the Order was made.

Mr. WEDDERBURN: The question is, Have the Board of Trade power to make the Order, there being an existing power already in the district?

The Committee, after a short deliberation, confirmed the Order.

Mr. WEDDERBURN: If within six months, the Cranbrook Company are affording a supply in any one of these parishes, the Mid-Kent Company shall not come in?

The CHAIRMAN: No; I do not think I can say that.

SOUTH LINCOLNSHIRE WATER BILL.

By this Bill it is proposed to incorporate the South Lincolnshire Water Company, with power to supply water within certain parishes in South Lincolnshire, to authorize the Company and the Spalding Urban District Council to construct works and provide water, and for other purposes. The capital is put at £30,000, with one-third borrowing powers. The Bill came before Lord ONSLOW (Chairman of Committees), last Tuesday, when some discussion arose on a proposed new clause which affected the Great Northern Railway Company. It was as follows: "The Company shall not supply any railway company with water within, or for use within, the urban district of Spalding, without the consent of the Spalding Council."

Mr. BAKER (the Agent for the Bill) said that at the present time the Spalding District Council received a revenue of £600 a year from the Railway Company, and they did not wish that this should be interfered with by the Bill. The Council's district was not within the promoters' area of supply, and he did not know why the Railway Company should object.

Mr. CRIPPS (of Messrs. Dyson and Co.) said the Railway Company had considerable objection to a clause of this sort.

Lord ONSLOW asked how they would be damnified by the clause, as they now got their water from Spalding?

Mr. CRIPPS replied that if the clause was literally interpreted, it meant that the Railway Company might not use water which it had carried into the Spalding district.

Eventually the words "or for use within" were struck out; and the Bill was ordered to be reported, with amendments.

Colne Valley Water Company.—The report to be presented at the sixty-fifth half-yearly meeting of the Colne Valley Water Company to-morrow, states that the profits in respect of the revenue account for the six months to June 30 amounted to £11,617; and the balance of the dividend and interest account, after paying the interest on the debenture stock and preference shares, is £11,917. The Directors have transferred a further £1000 to the contingency fund account, and now recommend dividends at the rate of 9 per cent. per annum on the 10 per cent. maximum dividend shares, and at the rate of 7 per cent. on the 7 per cent. maximum dividend shares, carrying forward £1479. For the corresponding period of 1905 the dividends were at the rate of 8½ per cent. and 7 per cent. respectively, the amount transferred to the contingency fund account was the same, and £1134 was carried forward. The capital expenditure in the past six months amounted to £2151, about half of which was incurred in the extension of mains, and the remainder in connection with the new works at the pumping-station. The Contractors are now proceeding with the erection of the new beam engine (in place of the two old horizontal engines); the pumps having already been placed in position. The sum of £3000 has been paid on account of this engine out of the contingency fund account; and it is proposed to take a further £2000 from the account when the engine is completed.

LEGAL INTELLIGENCE.

COURT OF SESSION—FIRST DIVISION.

Wednesday, July 25.

(*Before the Lord* PRESIDENT *and a Jury.*)

Claim for a Gas Explosion.

The trial took place to-day of an action arising out of an explosion of gas on the evening of Wednesday, Feb. 21 last, at No. 102, Oxford Street, South Side, Glasgow—a house occupied by a man named Walter Shearer. The action was brought by two sons of the occupant —Arthur, aged eighteen, and Michael, aged two. The former sued the owner of the house (Mr. Ramsay) for £450, the latter for £550.

The pursuers were represented by Mr. M'CLURE, K.C., and Mr. J. A. CHRISTIE; and the defender, by Mr. WATT, K.C., and Mr. A. A. FRASER.

It was stated for the pursuers that their father entered into possession of the house about four or five months prior to the accident. At the time, there was no gas-connection. The pipes were there; but there was no meter. On Feb. 21, on the instruction of their father, an official from the Corporation Gas Department put a prepayment meter into the house (which consisted of a room and kitchen), and connected it with the main. Shortly after the meter was put in, their father inserted a penny; and for some time gas was used in the kitchen. Between 6 o'clock and 6.30 the elder pursuer took a lighted candle to go into the room for a jacket; and when he opened the door, the explosion occurred. One of the walls of the room was completely blown out; and the lad was badly bruised, and was burned to such an extent as, it was believed, would lead to his permanent injury. The child, sitting by the kitchen fireside, was said to have been burned "almost to a cinder." Both suffered also from shock. On examination, it was found that there was a ½-inch pipe leading from the meter into the room, which had been broken off flush with the wall, and had been afterwards covered over with wall paper; the end being left open. Gas had not been used in the house for ten years; and it was thought the pipe had been in this condition for a long period. It was maintained that the defender ought to have made himself acquainted with the condition of his property, and have had the end of the pipe stopped, which would have rendered the explosion impossible.

For the defender, it was stated that, when the meter was put in, the Corporation official who did so turned on the gas, according to the universal practice, to discover if the pipes were leaking. When he did so, he showed the pursuers' father that the pointers of the meter were racing, informed him that there was a great escape of gas somewhere, and warned him that on no account was the gas to be turned on until the pipes were examined and the leak stopped. The pursuers' father said he would see the factors for the property at once; but instead of doing this, he looked for and found a leak in the kitchen pipe. Then, without making an attempt to discover the condition of the pipe in the room, he turned on the gas. The accident was thus directly caused by the recklessness of pursuers' father. It was further maintained that the lad Arthur was in fault in taking a lighted candle into the room; and that the injuries sustained were of a trivial description.

The Lord PRESIDENT, in addressing the Jury, pointed out that the two boys had no relation of contract with the defender, and that, therefore, in order to get a verdict, they must show fault against him. The question for them was one of fact—viz., was it the fault of the defender that this accident happened? It was rather beginning at the wrong end, because it was the duty of the pursuers to prove that there was fault; but one way for the defender to show that it was not his fault would be to prove that it was somebody else's, and another way would be to show that it was nobody's fault. The defender said that the accident was due to the fault of the father of the pursuers, because warning was given him that it was dangerous to light the gas, and he disregarded the warning. Now, if a distinct warning were given to the father, and he lighted the gas in spite of it, the pursuers could not ask a verdict, because of his negligence. There was a conflict of testimony as to the amount of warning which the father received. It might be all very well to say that there was a leak of gas, and that they had better not light it. He supposed they had all had experience with gas, and had had escapes in their houses; but nobody would say that, in consequence of this, it was absolutely wrong to light the gas. Therefore they had to consider whether something or other was said by the Corporation official which was a sufficient warning. If it were merely that there was a slight escape of gas, as Shearer said it was, that was not a warning of a character which would make fault lie on Shearer if he lighted the gas. If the warning truly were that it was dangerous to light the gas, he thought this would be warning of a nature which Shearer could only disobey at his peril—viz., making himself the true author of the accident. He was not going to say anything regarding the demeanour of the witnesses; but it was to be observed that the Corporation official did not discover the true extent of the danger. He admitted that he never found that there was anything like a ½-inch pipe open, though he was very anxious to do everything, apart from the business of the Corporation of Glasgow, to remedy affairs. It would have been perfectly inhuman if he had not been prepared to take upon himself a little more than the Corporation of Glasgow put upon him, and to have seen that the pipes were not left in a dangerous condition. Accordingly, not really knowing the true character of the danger, did his warning partake of the solemnity it would have had had he been truly awake to the state of affairs? Something was said about the racing of the meter-pointers; but he doubted whether any of the Jury would be able to stand cross-examination upon the rate at which the pointers in their gas-meters ought to go round, or to discover by their rate of travel whether there was a leak of gas. An expert gas man might do so; but he did not expect that a man of the class to which Shearer belonged would know anything about it. They had also to consider whether, if the warning had been of the solemnity which it should have been, it was probable that Shearer would have proceeded to do what would be likely to blow himself and his family up. He did not say this was conclusive, because people often did rash things; but it was a matter for consideration. Whether, however, warning were given or not, there was the further question of whether the defender was ever in fault at all. The measure of duty in a case of this sort was simply the measure of duty as between a landlord and tenant. A landlord was not liable for all his tenant did, provided he gave over the premises in proper condition. Therefore, if they could be sure here that the gas-fittings were originally given over in a perfectly and ordinarily safe condition, and that the tenant, by his own actions, proceeded to put them into an unsafe condition, and an accident afterwards happened, the landlord would not be liable. It was contended by the defender that this was what happened. He said—and there was no evidence against it—that the particular pipe was not put there by him; and that he did not exactly know who put it there, but that the surmise was that a tenant did so. But this tenant went away, and the house became again the possession of the landlord, who proceeded to let it to Shearer. It was just there that he thought the whole point of the case arose. If they came to the conclusion that this bad defect was one which the landlord, or his factor for him, could, in the ordinary exercise of duty, have discovered and remedied, then that was the fault of the landlord. But if, on the other hand, they came to the conclusion that the defect was of such a character that, not having been created by the landlord, but by someone else, it was not, in common sense, in the power of the landlord or factor to discover anything about it, then there was no fault on the part of the landlord. That was really where the case turned.

The Jury, after an absence of twenty minutes, returned a unanimous verdict for the defender.

Conviction for Slot-Meter Robberies.

At the Central Criminal Court on Monday last week, before the Recorder (Sir Forrest Fulton, K.C.), William Holden, a labourer, pleaded "Guilty" to stealing money from penny-in-the-slot gas-meters. It was stated that there had been 60 complaints of money being taken from these meters in the neighbourhood of Clerkenwell; but that the complaints had ceased since the accused had been in custody. The Recorder sentenced the prisoner to nine months' imprisonment, with hard labour.

Action Against the Voelker Mantle Company.

At the Bristol Assizes, recently, before Mr. Justice Lawrence and a Jury, an action was brought by Adolph Rosenthal against the Voelker Incandescent Mantle Company, Limited, for damages for wrongful dismissal. The plaintiff was formerly a partner in the business of Messrs. Stych and Rosenthal, dealers in mantles and gas-fittings, of Bath Street, Bristol. The business was subsequently acquired by the defendants, who appointed plaintiff as Manager at a salary of £3 per week and a commission. In February, 1905, an agreement was entered into between him and the defendants, by which he was to devote his whole time and services to the business on the financial conditions stated, and six months' notice was required on either side, to terminate in the corresponding month to that in which the agreement was executed. The plaintiff's case, as presented by Mr. B. R. Vachell, was that he discharged an employee who appeared to have been in confidential communication with Mr. Clark, the Company's Secretary and General Manager in London, who accused the plaintiff of irregularities and dismissed him. The defence, which was conducted by Mr. Holman Gregory, was that the plaintiff was only suspended, pending a report of the facts being made to the Directors of the Company. The Jury found for the plaintiff in the sum of £100.

The Water Rights of the Neath Corporation.

In the Chancery Division of the High Court of Justice last Wednesday, Mr. Justice Kekewich gave judgment in an action which had occupied him for two days. It was brought by members of a family named Thomas, the owners of the Gnoll Castle Estate, against the Corporation of Neath, claiming a declaration that the defendants were not entitled to lower the water in certain ponds, from which they had a right to take and use water, beyond a certain point, in breach of a covenant contained in a deed dated Aug. 31, 1868. By this deed, the right of taking, for the purposes of the water supply authorized by the Neath Water Supply Act, 1851, and the Neath Water Extension Act, 1865, from the estate, such a quantity of the surface water of certain ponds as the Neath Water Company should reasonably require, was granted to them; and it was agreed that the Company should not at any time, without the consent of the owner of the freehold, lower the surface of the water in the ponds more than 4 feet below the line of highest water in such pond until it should have been deepened at least 2 feet more than its then depth, or more than 6 feet below the line of highest water after the pond should have been so deepened. The Company were not at any time to lower the water in the ponds so as to leave less than 6 inches in the shallowest part. The undertaking of the Company became vested in the defendants on Sept. 29, 1894; and the deed above referred to was binding upon them. The plaintiffs alleged that the defendants had lowered the water in the ponds in breach of the covenant. The defendants claimed the right to lower the water, and said the plaintiffs had waived and released their rights under the covenant, and that it was essential for the health and safety of the district that sufficient water (which the defendants were under a public duty to furnish) should be obtained, which could not be done without lowering the water in the ponds. They also alleged that the surface of the water had been lowered from time to time during the last thirty years, and that consequently the plaintiffs had, by their delay, acquiescence, and lapse of time, lost their rights under the covenant and their claim to relief in this action. In the result, his Lordship decided that the Corporation were not entitled to lower the surface of the water more than 4 feet below high-water mark, and that therefore the plaintiffs were entitled to the declaration claimed. The defendants would have to pay the costs of the action.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY'S ACCOUNTS.

[For the Half-Yearly Report, see p. 297.]

The accounts of the Company for the six months ending June 30, to be submitted with the Directors' report on Friday, consist of the usual statements, from which we take the following particulars.

The statement of capital (stock) sets forth that the total paid up is £9,466,500; added on conversion, £12,176,565—total amount authorized, £21,643,065. Deducting the amount redeemed, £40,090, the total amount of the Company's existing capital powers is £21,602,975. The statement of loan capital stands thus: Total paid up, £2,844,000; added on conversion, £1,479,975; unissued, £750,000—total amount authorized, £5,073,975.

The capital account shows receipts (with premiums, £1,586,807 11s. 9d.) to the amount of £27,513,757 11s. 9d. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1905			£13,370,052 1 2
Expenditure during the half year to June 30, 1906—viz.,			
Buildings and machinery in extension of works.	£5,433 5 6		
New and additional mains and service-pipes. .	13,991 6 11		
Do. do. meters	22,372 1 4		
Do. do. stoves	11,612 7 4		
	£53,409 1 1		
Sale of surplus land	£4,860 12 4		
Sale and depreciation of plant . .	29,475 10 0		
	34,336 2 4		19,072 18 9
Total expenditure			£13,389,124 19 11
Nominal amount added on conversion			13,656,540 0 0
			£27,045,664 19 11
Deduct amount of capital redeemed under Company's Act of 1903 (per previous account, £19,965; this half year, £20,125)			40,090 0 0
			£27,005,574 19 11
Balance of capital account			508,182 11 10
			£27,513,757 11 9

The balance applicable to the redemption fund and to dividend on the ordinary stock is £554,949 12s. 2d.; and the following statement shows how it is proposed to appropriate it.

June, 1905.			
£248,193	..	Net balance brought from last account	£181,298 12 4
3 4,126	..	Net revenue for the half year	373,650 19 10
£562,319			£554,949 12 2
10,000	..	Contribution to redemption fund	10,000 0 0
(£4 8s. per cent.)		Dividend on the ordinary stock—	
£334,911	..	£4 8s. per cent. per annum on £15,203,110 . .	334,468 8 5
£217,408	..	Balance carried to next account	£210,481 3 9

The following is the revenue account:—

Expenditure.

June Half Year, 1905.		£ s. d.	£ s. d.
	Manufacture of Gas—		
£496,174	Coal into store	500,940 6 11	
83,752	Oil ,,	78,536 5 5	
31,965	Coke and Breeze used in the manufacture of Carburetted Water Gas . .	27,144 13 5	
14,547	Salaries of Engineers and other officers	15,356 19 0	
116,213	Wages, gas making £107,999 7s. 9d.	124,650 11 11	
16,837	,, sundries . £16,651 4s. 2d.		
47,016	Purification, including £15,789 1s. 11d. for labour	35,402 5 5	
170,806	Repair and maintenance of works and plant, materials and labour, less received for old materials, £7488 12s. 6d.	199,794 2 8	
	Distribution of Gas—		981,825 4 11
41,103	Salaries and wages of officers (including Rental Clerks)	41,966 0 10	
56,012	Repair and maintenance of mains and service-pipes	60,279 11 4	
28,812	Repair and renewal of meters	28,927 7 10	
36,896	,, ,, stoves	36,391 0 0	
			167,564 0 0
19,335	Public lamps—Lighting and repairing .	..	19,690 10 8
	Rents, rates, and taxes—		
5,813	Rents payable	5,781 16 3	
146,855	Rates and taxes	144,197 9 0	
			149,979 5 3
	Management—		
2,750	Directors' allowance	2,750 0 0	
212	Company's Auditors and Assistant . .	200 0 0	
7,844	Salaries of General Manager, Secretary, Accountant, and clerks	7,655 5 5	
24,373	Collectors and Cashiers	22,769 13 0	
7,633	Stationery and printing	5,628 18 2	
3,454	General charges	4,427 11 0	
			43,475 8 5
2,300	Parliamentary charges	..	663 19 3
1,128	Law charges	..	1,336 1 8
1,527	Charges *re* quinquennial re-valuation . .	..	350 0 0
6,323	Bad debts	..	5,250 9 1
500	Depreciation fund for Works on Leasehold Lands	..	500 0 0
22,461	Annuities, including contribution to officers' superannuation fund	..	23,322 9 0
1,036	Workmen's compensation account . .	..	1,528 11 2
	Public officers—		
1,252	Gas Referees and Official Auditor . .	1,280 0 10	
689	Public testing-stations	1,008 14 2	
			2,288 15 0
£1,396,548			£1,397,774 14 5
509,223	Balance carried to net revenue account		569,878 19 10
£1,905,771			£1,967,653 14 3

Receipts.

June Half Year, 1905.		£ s. d.	£ s. d.
	Sale of gas—		
	Per meter, at 2s. 11d. and 2s. 2d. per 1000 cubic feet	1,480,734 18 4	
£1,424,845			
67,901	Public lighting and under contracts . .	68,920 4 5	
			1,549,655 2 9
£1,492,746			
34,669	Rental of stoves	..	37,195 10 9
	Residual products—		
£216,013	Coke, less £35,114 11s. 7d. for labour, &c.	211,962 11 1	
14,428	Breeze, less £3191 0s. 3d. for ditto . .	14,470 9 4	
48,632	Tar and tar products	50,959 6 0	
94,322	Ammoniacal liquor and sulphate of ammonia	98,577 17 6	
			375,970 3 11
£373,395			
£4,620	Rents receivable		4,522 14 4
341	Transfer fees		310 2 6
£1,905,771			1,967,653 14 3

The three statements relating to the reserve, insurance, and depreciation funds show that the balances on June 30 were as follows: Reserve fund, £61,443 0s. 10d.; insurance fund, £86,850 9s. 7d.; and depreciation fund, £61,868 14s. 3d. The insurance fund had to bear in the past half year a sum of £685 9s. 1d., a further payment on account of claims in respect of the Southampton Row explosion on Dec. 14, 1904.

The following statements relate to the working:—

Statement of Coals Used, &c.

Description of Coal.	In Store Dec. 31, 1905.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store June 30, 1906.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common. . . .	206,667	799,024	870,886	1,886	132,919
Cannel . . .	12,953	..	17	..	12,936
Total . . .	219,620	799,024	*870,903	1,886	145,855

* In addition to this quantity of coal, 7,405,484 gallons of oil and 52,412 gallons of spirit were used during the half year.

Statement of Residual Products.

Description.	In Store Dec. 31, 1905.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1906.
Coke—tons	8,958	547,923	112,589	433,794	10,498
Breeze—tons	10,985	95,562	13,416	81,204	11,927
Tar—gallons	828,506	8,298,992	8,483,459	12,578	631,461
Ammoniacal liquor—butts	19,834	247,285	248,804	..	18,315

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights and Under Contracts. (Estimated.)	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
*11,727,275	468,366	10,394,589	11,001,293	49,699
†11,283,976	463,121	9,987,774	10,586,687	49,695

* Including 2,502,930,000 cubic feet of carburetted water gas. † June half year, 1905.

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £95,193; oil and petroleum spirit, £38,105; coke, £4934; tar and ammoniacal liquor and products, £79,727; and sundries, £250,098. The figures this time last year were: Coal, £119,787; oil and petroleum spirit, £43,806; coke, £17,687; tar and ammoniacal liquor and products, £67,493; and sundries, £243,712.

SOUTH METROPOLITAN GAS COMPANY'S ACCOUNTS.

[For the Half-Yearly Report, see p. 297.]

The following are the principal portions of the accounts of the Company for the six months ending June 30.

The first two statements relate, as usual, to the stock and loan capital. The former sets forth that the standard rate of 4 per cent. is payable on £6,011,224 and £338,776 (Act of 1901) of stock; while the latter shows that the loan capital, the rate of interest on which is 3 per cent., amounts to £1,798,994 and £96,451 (Act of 1901). The third statement is the capital account. It stands as follows: Amount received, £5,226,554; nominal amount added by conversion (less premium), £3,018,891—total, £8,245,445. The items of expenditure are as follows:—

Capital account to Dec. 31, 1905			£4,865,142 15 7
Expenditure during half year to June 30, 1906, viz.—			
New buildings and machinery in extension of works	£6,935 15 1		
New and additional mains and services . . .	21,176 3 3		
New and additional meters	11,204 15 8		
New and additional stoves	5,022 5 8		
		44,338 19 8	
Total expenditure			£4,909,481 15 3
Balance			317,072 4 9
			£5,226,554 0 0
Nominal amount added by conversion, less premium			3,018,891 0 0
Total			£8,245,445 0 0

The following is the revenue account:—

Expenditure.

Manufacture of gas—			
Coal into store, including £24,580 10s. 3d. for labour	£330,187 3 11		
Purification, including £8934 12s. 6d. for labour	13,747 14 5		
Salaries of Engineer and Officers at works	13,537 2 3		
Wages (carbonizing)	57,152 11 11		
Repairs and maintenance of works and plant, including £47,800 5s. 11d. for labour, less £5583 4s. 4d. received for old materials	93,662 19 4		
		£508,287 11 10	
Co-partnership for twelve months to the 30th of June	£43,961 19 7		
Less on Account	18,000 0 0		
		25,961 19 7	
Distribution of gas—			
Repair, maintenance, and renewal of mains and service-pipes, including £17,123 10s. 1d. for labour	£27,981 18 6		
Salaries and wages of officers, including rental clerks	17,462 5 1		
Repairing and renewals of meters, including £4785 12s. 5d. for labour	22,129 15 2		
Repairing and renewals of stoves, including £10,351 19s. 11d. for labour	23,103 3 8		
Gas-fittings (labour)	3,438 12 2		
		94,115 14 7	
Public lamps, including £11,320 17s. 11d. for labour, and £5817 5s. 1d. for materials, less £16,389 15s. 2d. received for the same		748 7 10	
Rents, rates, and taxes—			
Rents payable	£1,340 8 0		
Rates and taxes	41,450 9 2		
		42,790 17 2	
Management—			
Directors' allowance	£2,531 18 0		
Salaries of Secretary, Accountant, and clerks	3,756 8 0		
Collectors { Ordinary	6,223 17 2		
Collectors { Slot meter	7,834 9 5		
Stationery and printing	3,074 7 10		
General charges	9,259 14 5		
Company's Auditors	112 10 0		
		32,793 4 10	
Law charges	£1,535 8 2		
Parliamentary charges	336 8 1		
		1,871 16 3	
Bad debts		1,498 16 5	
Pensions and officers and workmen's superannuation, sick, and accident funds		7,056 1 11	
Gas Referees and Official Auditor		376 5 2	
Leasehold renewal fund		300 0 0	
Total expenditure		£715,800 15 7	
Balance carried to net revenue account		207,635 12 7	
		£923,436 8 2	

Receipts.

Sale of gas—			
Lady Day, at 2s. per 1000 feet	£357,214 11 6		
Midsummer, at 2s. per 1000 feet	246,640 17 1		
	£603,855 8 7		
Public lighting	14,951 12 8		
		£618,807 1 3	
Meters in use (309,048)—			
Company's meters at rent: Ordinary, 102,169; slot, 198,080	£33,566 7 7		
Company's stoves at rent: Ordinary, 71,501; slot, 167,242; fires, 19,994	27,063 5 7		
		60,629 13 2	
Residual products—			
Coke, less £1699 5s. 2d. for cartage; £14,970 14s. 11d. for labour, &c.	£146,584 18 1		
Breeze, less £566 4s. 3d. for cartage; £2563 11s. 5d. for labour, &c.	5,324 10 5		
Tar and tar products, less £5192 0s. 8d. for labour	34,047 12 2		
Sulphate of ammonia, less £5583 4s. 2d. for labour	56,505 15 0		
		242,462 15 8	
Rents receivable		1,434 13 1	
Transfer fees		102 5 0	
Total receipts		£923,436 8 2	

The net revenue account shows a sum of £180,575 2s. 1d. applicable to dividend on the ordinary stock. Following this are the statements relating to the reserve, renewal, and insurance funds. They show that the balances on June 30 were as follows: Reserve fund, £176,934; renewal fund, £24,767; insurance fund, £106,731.

The statements furnishing manufacturing details are as follows:—

Statement of Coal.

In Store Dec. 31, 1905.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store June 30, 1906.
Tons.	Tons.	Tons.	Tons.	Tons.
111,239	545,065	586,950	895	68,459

Statement of Residual Products.

Description.	In Store Dec. 31, 1905.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1906.
Coke—cwts.	126,190	7,239,992	1,697,887	5,507,631	160,664
Breeze—yards	26,132	147,751	74,090	84,890	14,903
Tar—gallons	799,870	5,841,377	5,863,968	46,032	731,247
Ammoniacal liquor—butts	16,673	188,397	196,189	..	8,881

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights (estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	22,013 incandes't
6,428,595	224,482	6,035,235	6,337,192	903 flat flame

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £38,452; coke and breeze, £6100; tar, sulphate, and ammoniacal liquor, £45,606; and sundries, £264,662. The figures this time last year were: Coal, £31,692; coke and breeze, £17,641; tar, sulphate, and ammoniacal liquor, £47,733; and sundries, £240,876. A sum of £66,071, workmen's bonuses and savings, has been deposited with the Company; and the total of the officers' superannuation and guarantee funds is £34,092. The figures last year were £73,424 and £27,716. The new item, "Monazite sand suspense account," now stands at £19,420, compared with £24,139 at the end of December last.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

In their report to be presented at the half-yearly ordinary general meeting of the Brentford Gas Company next Friday the Directors record, with great satisfaction, the rejection of both the London Outer-Circle Railway Bill, which, they say, as promoted, would have very materially damaged their property at Southall, and the London County Council Electric Supply Bill, to which they had offered strenuous opposition before the Parliamentary Committee. They point out, however, that the expenses attending the opposition have been heavy. The market for residual products still remains in a depressed condition; but the general business of the Company continues to increase. The Directors report the resignation of his seat at the Board by Mr. J. W. Field, who, for a short time only, has been able to give the Company the benefit of his great experience in gas matters. Mr. Field's retirement is very much regretted by all his brother Directors, especially as it has been caused by failing health. The Board have elected Mr. H. H. Batten to fill the vacancy thus created.

The accounts accompanying the report show that the revenue from the sale of gas was £156,896, against £153,366 in the first half of 1905; and meter and stove rents produced £15,953, compared with £15,254. Residual products yielded £28,761, against £29,595. The total receipts were £201,651, and the expenditure was £158,457; leaving £43,194 to go to the net revenue account, against £44,259 carried to that account this time last year. The amount available for distribution is £93,947; and the Directors recommend dividends at the rates of 5, 12½, and 9½ per cent. per annum on the preference, consolidated, and new stocks respectively. The working statements show that 78,611 tons of Newcastle coal, and "Solar" oil equivalent to 33,998 tons were used in the half year in the production of 1,221,359,000 cubic feet of gas, of which 1,132,836,000 cubic feet were sold and 1,147,836,000 cubic feet accounted for. The estimated quantities of residuals were: Coke, 49,070 tons; breeze, 6121 tons; tar, 908,257 gallons; ammoniacal liquor, 23,201 butts.

LEAKAGE FROM GAS-MAINS INTO DWELLINGS.

At the Meeting of the London County Council to-day, the Public Control Committee will present the following report on the above subject.

The Council on March 7, 1905, referred to us to consider and report what action should be taken with a view to the prevention of dangerous leakages from gas-mains into dwelling-houses. We have given the matter our most careful attention; but the Council will recognize that the question is one of considerable difficulty, owing to the absence of reliable data as to the number of accidents arising from the cause mentioned. Under section 8 of the Gas-Works Clauses Act, 1847, mains may be laid by a gas company subject to three days' notice to the road authority, and also to special notice to anyone whose property is thought by the company likely to be injuriously affected; but under section 24 a gas company are liable, in the event of an escape of gas from any pipe laid down, set up, or belonging to them, to a penalty of £5 for every day during which such escape continues after the expiration of 24 hours from the service of notice of such escape. These powers, however, are not sufficient to give the local authority adequate control over the laying and relaying of gas-mains; and we are of opinion that it would be well if the Council took steps to secure better control over gas companies in this respect. The Highways Committee, with whom we have been in communication on the subject, suggest that endeavours should be made to obtain the insertion in all future Bills promoted by gas companies having power to execute works within the County of London, of a clause prepared on the lines of the "notice of works" section of the Electric Lighting Orders, so as to secure the desired control over the mains. We concur in this suggestion, and have accordingly communicated with the Parliamentary Committee, asking them to take the necessary steps in the matter. We recommend: "That the reference of March 7, 1905, to the Public Control Committee to consider and report what action should be taken with a view to the prevention of dangerous leakages from gas-mains into dwelling houses be discharged."

Embezzlement by a Gas Collector.—At the Westminster Police Court, last Wednesday, Robert L. Dillon, for many years a collector in the service of the Gaslight and Coke Company, at a salary of £335 a year, pleaded guilty to embezzling £31 belonging to the Company. Before he absconded, it was stated, he applied £20 of his salary to reduce the deficiency in his accounts. He told the Magistrate that the Company had £179 in the guarantee fund to his credit, and that he would forfeit all this. The Magistrate replied that it was incomprehensible that a man should forfeit his position and emoluments in this way. For the defence, it was contended that there were "fearful temptations" in the Strand district, in which defendant worked—wine flowing like water at restaurants and large licensed places where he had had to call. The Magistrate, however, in sentencing him to two months' imprisonment in the second division, remarked that it was not much in his favour that he yielded to such temptations.

LIGHTING OF PARLIAMENT STREET AND WHITEHALL.

Victory for Gas.

At the Meeting of the Westminster City Council on Thursday, the Works Committee brought up a long report, accompanied by a recommendation, as to the lighting of Parliament Street and Whitehall.

The Committee said they had again considered their report of the 23rd of May,* which was referred back to them, recommending the acceptance of the tender of the Gaslight and Coke Company for lighting and maintaining high-pressure gas-lamps in Whitehall and Parliament Street, not included in any other contract. They had received tenders from the Gas Company and from the Westminster Electric Supply Corporation. The former tendered for the supply of new lamp-columns and lamps where none now exist, for the sum of £17 per lamp, and for the maintenance and lighting of the whole of the lamps for £15 1s. per lamp per annum. The Electric Supply Corporation submitted two tenders—one for the supply and fixing of "flame" arc lamps and lamp-posts, to remain the Company's property, and for the maintenance and lighting of the lamps on the following terms: No charge to be made for the first eighteen months, and the charge for the remaining 3½ years to be the same as charged for the arc lamps in the St. George, Hanover Square, district; the other for the supply and fixing of "Oriflame" 9-ampère "flame" arc lamps and lamp-posts for the sum of £42 10s. per lamp, and for the lighting and maintenance of the lamps for the first eighteen months free, and the remaining 3½ years at £17 15s. per annum, less the rebate in force at the time under the St. George's lighting contract. By the first tender the average price per lamp per annum for maintenance and lighting was £14 16s. 10d., the lamps and posts remaining the property of the Company; while by the second it was £11 19s. 5d., the City Council paying for the installation at the rate of £42 10s. per lamp. In a letter dated the 31st of May, to the City Engineer (Mr. J. W. Bradley, M.Inst.C.E.), the Electric Supply Corporation pointed out that as the electric lamps to be erected by them would give 1200-candle power apiece, instead of the 900-candle power tendered for by the Gas Company, three electric lamps would give the same candle power as four gas-lamps; and therefore, if 20 gas-lamps were required to light the street, only 15 electric lamps would be needed, and the actual cost per annum would then work out as follows: Electric lamps (15): £266 16s. 3d. under first tender, £227 12s. 6d. under second tender. Gas lamps (20): £301. The Gas Company, however, stated in their letter of the 22nd of June, that to ensure a minimum light of 900-candle power it would be necessary for them to supply gas-lamps giving an average light of 1100 to 1200 candle power at the ground level, or 1400-candle power at the horizontal; so that the gas-lamps would give greater light than the arc lamps, and the light would be much more evenly diffused, and therefore more efficient and economical. In referring the report back, the Council took exception to the proposal that their standard clause relating to rates of wages and hours of labour should be waived; and the Committee invited the observations of both tenderers on the point. The Electric Supply Corporation stated that their rates of wages and hours of labour would compare favourably with any in the district; and therefore whether the clause was or was not retained would not affect their tender. At the same time, they thought that, as the tender was asked for under definite conditions, any alterations should be made by the Committee and notified to all parties tendering before the tenders were opened. The Gas Company by letter dated the 22nd of June, stated that the relations of the Company and their employees had not altered since the date on which the Council accepted their tender for the Aldwych system of lighting, when the Council agreed to waive the clause after carefully considering the matter and after receiving a report from the Chairman of the Works Committee. The Company quoted extracts from this report, and asked that the course adopted in the case of the Aldwych tenders might be followed in this instance. Under all the circumstances, the Committee came to the conclusion that it was advisable to accept the lower tender of the Electric Supply Corporation; and they recommended accordingly.

Mr. C. SPENCER-SMITH, the Chairman of the Committee, declined to move the adoption of the report—explaining that he did not approve of it.

Alderman EVERITT then submitted the necessary motion. He said that many reports and pamphlets had been issued by the two competing Companies on the question now before the Council, and there appeared to be a great deal of feeling on the matter. He, as a representative of the ratepayers, was pleased to see this keen competition between electricity and gas, and was sure that if it had existed seven or eight years ago the City would have been saved £7000, £8000, or £10,000 a year. He had not a word to say against the Cas Company, and was pleased to see the energy they had lately put into their business; for they had shown more energy and enterprise during the last four years than they had done in the preceding forty. He was in favour of the acceptance of the Electric Supply Corporation's tender because the Gas Company wished the Council to alter their rules. The Council on one occasion had acceded to the request of the Gas Company to strike out the clause relating to Trade Union conditions; but, in his opinion, this precedent was one which ought not to be followed. The Gas Company paid their men just and fair wages ["No, no," from the Labour benches]; at any rate there had been no direct complaint from the men. But this was not the point, which to his mind, was that the Council should not permit the Company to alter the conditions of the tender. He did not believe there was one member of the Council who, having read the literature which had been circulated by the rival Companies, could say which of the two tenders was the cheaper. But the Council's Engineer, who had gone into the matter, had expressed the opinion that it was certainly the one for electric lighting.

Mr. TOZER, in seconding the motion remarked that if the Council accepted the Electric Supply Corporation's tender, they would at the end of five years obtain the current at a reduced charge.

* See "JOURNAL," Vol. XCIV., p. 651.

Lieut.-Col. HILL-JAMES thought it was very desirable that there should be no radical change in the present system of lighting the streets until the contracts fell in in three or four years' time. Then they could go into the whole question with the view of obtaining a uniform system of lighting. It was to be remembered that it was on the advice of Sir William Preece, who was generally recognized as the greatest living expert on electricity, that Westminster, six years ago, adopted it for street lighting. What was Sir William's opinion now? According to a newspaper report, which had not been contradicted in any shape or form, Sir William had advised a certain Harbour Trust to adopt incandescent gas in preference to electricity, as, in his opinion, the former was the better illuminant for all public purposes. If this advice had been given to Westminster some few years ago, they would now be saving £10,000 a year on their lighting bill. The speaker went on to refer to the highly successful results of gas lighting in the City of London and in the Victoria Railway Station; and he said that if the tenders before the Council were fairly considered, that of the Gas Company must be accepted.

Mr. TASKER said, if the Gas Company had not put in a tender, that submitted by the Electric Supply Corporation would have been very much higher. It was most desirable, in the interests of the ratepayers, that the competition should be kept up; but if they accepted the tender of the Electric Supply Corporation they would be going far to establish a monopoly. Alderman Everitt had said that the Gas Company treated their workmen fairly. This was undeniably the case; and that being so, the clause which had been struck out was unnecessary.

Mr. NEVE expressed the opinion that electricity was the proper light for street lighting, as gas was not up-to-date.

Alderman EMDEN said the question the Council had to consider was not so much the point as to the Trade Union clause, but which was the best and most economical system of lighting. In his opinion, gas was much to be preferred. It had greater penetrating power in case of fog and mists, and the light from the lamps was better distributed. The most enlightened city in the world—*i.e.*, the City of London—had replaced electricity by gas as the result of a series of trials, and after fully going into the question of the merits of the rival illuminants. If Westminster accepted the Electric Corporation's tender, they would discourage the Gas Company from continuing a competition which was greatly to the benefit of the ratepayers. A very bad case had been made out for the electric light.

Mr. EVANS said the Electric Supply Corporation put forward, as an excuse for supplying the light free for eighteen months, that during this period they were to carry out experiments. In his opinion, if they wished to carry out experiments they ought to do so in some other place than in the important thoroughfares in question. Notwithstanding, however, their kind offer of eighteen months' free lighting, their tender for the five years worked out to at least as much as gas. The backbone of the opposition to the Gas Company was the Labour party, who objected to the deletion of the Trade Union clause.

Mr. SPENCER-SMITH moved, as an amendment, that the tender of the Gas Company be accepted. He said that hitherto the policy of the Council had been to encourage healthy competition between the two systems of lighting, and the acceptance of the tender for electric lighting would tend to discourage competition. Whichever way they took it, the difference in cost between the two tenders was a mere bagatelle. But, in his opinion, gas was the best illuminant for street lighting; and he was fortified in this opinion by the recently-issued report of the City of London Engineer. The whole issue turned upon the Labour question; but Alderman Everitt had admitted that the Gas Company treated their employees well. Therefore there was no need for the clause which had been struck out.

Mr. HEYWOOD remarked that the Gas Company had made several alterations in the specification beyond the Trade Union clause, and actually insisted that notice should be given of any tests which were to be made, so that they would have an opportunity of getting up the right pressure and supplying the right light. With regard to the rate of wages paid by the Gas Company, inquiries showed that a large number of their men only received 21s. a week.

Mr. GATTI said it was only by maintaining the conditions of a contract intact, and judging the tenders on their merits, that they could maintain efficient competition. The moment the Council allowed other considerations to enter, the keenness to cut ceased. There was no doubt that, for awhile, the new system of high-pressure gas lighting compared favourably with the old arc; but the new arc was as much in advance of the old as incandescent gas lighting was in advance of the flat-flame burner. Much had been said about the Victoria Station; but he was in a position to say that the contract for the Charing Cross Station, after an exhaustive series of tests under impartial supervision, had resulted in the contract going to electricity. Each illuminant had been on top in turn; but the new arc had now put electricity on top. Gas could not compete with it unless it was reduced from 2s. 11d. to 1s. 6d. per 1000 cubic feet.

Mr. BANNOCHIE said the question as to a Trade Union rate of wages did not really enter into the matter at all. He, however, opposed the acceptance of the Gas Company's tender because he considered that gas was responsible to a great extent for the mists and fogs which prevailed in the Metropolis.

Mr. BURCH said there had been some very special pleading on behalf of the electric light. Some of the most fervent advocates of electricity were interested in the promotion of electric lighting companies. Other fervent advocates had their money locked up in these companies; while there were others who hoped to be benefited in some way or other through the success of electricity. If they took out all those who were interested in electric lighting companies, and all those who hoped for benefits therefrom, there would be but very few members supporting electric light.

Mr. GATTI said that on two or three previous occasions, when similar questions were before the Council, he had explained that, though he was not interested in the tendering Corporation, he was largely interested in electric light.

Mr. BURCH remarked that Mr. Gatti was so far interested in electricity that he naturally desired to see its success everywhere. For his own part, he thought Westminster could not do better than follow the

example of the City of London. It was all very well to advocate electricity when the ratepayers had to pay for it; but one of the strongest advocates on the Council for this system of lighting had actually recently replaced electricity by gas on his own private premises. It was now generally acknowledged that gas was the best for street lighting purposes. The front of Buckingham Palace had lately been lighted by gas; and so was all the vicinity, except the Mall.

On a show of hands, 19 voted for the amendment and 19 against it. A division was claimed, and resulted in the amendment being carried by 21 votes to 19.

Alderman EVERITT asked what was the position of the Council with regard to the Trade Union clause.

The MAYOR (Major-General Lord Cheylesmore): As the amendment is carried, the clause is waived.

On the amendment being put as a substantive resolution, several amendments were proposed with the object of having the matter reconsidered by the Committee; but these amendments were refused by the Mayor.

A long and heated discussion ensued.

Mr. SPENCER-SMITH appealed to the opposition to allow the matter to go through, as they had been beaten in a square fight.

Alderman EVERITT moved, as an amendment, that the Gas Company be not allowed the use of the Parliament Street subway for their gas-compressing plant.

Alderman EMDEN remarked that it was quite beneath the dignity of the Council to pick little holes in the agreement.

The opposition at this point degenerated into obstruction, and the Mayor intervened and said the advocates of electric light were, in his opinion, not behaving in a way at all consistent with the dignity of the Council.

On a division, Alderman Everitt's proposal was not carried; the voting being 19 to 19.

The MAYOR said it had been brought under his notice that a shareholder in the Westminster Electric Supply Corporation had voted in the division. He (the Mayor) should certainly not have allowed him to vote, and he had voted at his own risk.

Alderman EVERITT said the gentleman in question had asked his opinion on the matter, and he had advised him to vote, as the question was not the acceptance of the contract.

The MAYOR: The question was directly connected with the contract for which his Company had sent in a tender.

An amendment that the further discussion on the matter be postponed till after the holidays was not carried; the voting being 18 to 18.

The substantive resolution that the Gas Company's tender be accepted was put, when 18 voted for and 17 against it.

A division was called for, and the motion was then finally carried by 19 votes to 18.

The discussion occupied nearly two hours.

IMPROVED PUBLIC LIGHTING AT SCARBOROUGH.

Incandescent Gas Lighting on St. Nicholas Cliff.

In view of the importance of St. Nicholas Cliff, Scarborough, as one of the most frequented resorts of the residents and visitors, the Corporation have for some time been considering the advisability of improving the lighting. After consultation with Mr. A. Allan, the Gas Company's Engineer and Secretary, the Lamps Sub-Committee—represented by Messrs. H. Stephenson (the Chairman) and Mr. M. T. Whittaker, who have taken very great interest in the matter—decided to rearrange the whole of the lighting of the cliff, and to instal Sugg's latest pattern "Brixton" lamps, with columns, exactly similar to those erected on the new Marine Drive, which are of a very neat and elegant design. Each lantern contains a cluster of four Kern burners, giving an illuminating effect of 560-candle power. As there are twelve of these lamps, with an additional two-burner lamp, the total illuminating power will be equal to 7000 candles, which is more than double the amount of light previously given. The improved lighting of the Cliff is very much in evidence, and no doubt is highly appreciated by the general public as well as by the numerous visitors who take advantage of this prominent eminence for obtaining a view of the surrounding beauties of the bay. It has been customary at the end of the season to revert to the old flat-flame burners in place of incandescents, as the old lamps were not suitable for incandescent lighting; but with the improved "Brixton" lamps, it will not be necessary to make any change, as when the lighting is reduced at the end of the season it is intended to disconnect two of the burners in each lamp, leaving the other two for lighting purposes in the winter. This arrangement during the winter months will also give a very greatly improved light over the old system. As the saving in gas in the winter will balance the extra consumption during the summer, it is not anticipated that the cost of the scheme will entail any additional expense to the Corporation, who, as well as the Gas Company, are to be congratulated on this improved lighting. In noticing the new installation, a local paper says: "The Gas Company are at all times desirous of giving the Corporation every assistance with regard to the efficient lighting of the town, and have always shown a special desire to assist the Council in converting the old flat-flame burners into incandescents. In the present instance, they have decided to defray the whole of the cost of the installation, as they feel that the Cliff, being an important centre of the town, should be well lit, and by lamps of artistic design."

Uxbridge Water Supply.—On behalf of the Local Government Board, Colonel W. R. Slacke recently held an inquiry into an application of the Uxbridge Urban District Council for sanction to borrow £6000 for improvements in the water supply. The Clerk to the Council (Mr. W. T. Harvey) and the Consulting Engineer (Mr. F. S. Courtney) explained that the loan was required for the erection of pumping-machinery at the water-works, the construction of a water tower and tank, the laying of mains, &c. There was some opposition to the proposal.

LONDON IRONMONGERS AND THE GAS-STOVE TRADE.

Agreement with the Gaslight and Coke Company.

We learn from the current number of "The Ironmonger," that one of the most important pieces of work yet accomplished by the Ironmongers' Federated Association was started last week by the publication of certain letters. The first was by Mr. R. H. Smith, stating that the parties to whom it was addressed would by the next post receive a communication from the Gaslight and Coke Company intimating to them that the Directors were willing to grant certain concessions in respect of the sale of general gas appliances, and also to allow them, under certain conditions, special reductions on gas consumed on their business premises. The arrangements proposed were the out come of a conference held at the Gas Exhibition at Earl's Court. The full details of the scheme it was proposed to discuss at a meeting which he had suggested to the Company should be held last Thursday, when the Company's Chief Inspector (Mr. F. W. Goodenough) would be present to discuss any points arising out of the Company's proposals.

The communication above referred to, which was dated the 23rd inst., emanated from the Chief Office of the Company, and was signed by the General Manager (Mr. D. Milne Watson). It was as follows:—

Dear Sir,—With a view to securing the active co-operation of the principal ironmongers throughout their district in spreading the use of gas cooking and heating stoves, and of incandescent gas-fittings, the Directors of this Company have authorized me to offer you special terms in connection with the sale or hiring out of gas-stoves and other gas appliances, and I have pleasure in sending you herewith a copy of a form of agreement embodying these terms.

Gas for lighting has, as you are doubtless aware, made great strides in public favour of recent years, while our statistics show a steady and growing increase in the popularity of gas cooking and heating stoves. There is, however, still a wide field for the extended use of gas for these purposes, and it is believed that, if you and others connected with the ironmongery trade in London elect to co-operate with the Company actively in the manner suggested, and determine to take all the many opportunities open to you for recommending the use of gas to the public, considerable benefit will accrue to both parties.

If you wish to accept the Company's offer, will you please communicate with me, when I will give instructions for the Company's representative to call upon you. Should there be any point arising out of these proposals which you would like to discuss before coming to a decision, the Company's Chief Inspector (Mr. F. W. Goodenough) will be pleased to see you on the subject by appointment; but as I understand that the Ironmongers' Federated Association have called a special meeting for the 26th inst., for the purpose of discussing the Company's proposals, at which Mr. Goodenough will be present, it would probably be to the advantage of all parties, and a great saving of time, if you would arrange to attend that meeting, when the points you may desire to raise could be fully discussed.

The draft agreement enclosed in the letter was as follows:—

MEMORANDUM OF AGREEMENT between

of Ironmongers (hereinafter referred to as "the Ironmongers") of the one part, and the Gaslight and Coke Company, whose principal Office is at Horseferry Road, in the City of Westminster (hereinafter referred to as "the Company") by Henry Rayner, their Secretary, of the other part, whereby it is agreed as follows:—

1.—The Ironmongers shall display in the ironmongery department of their shop or shops, as set out in the schedule hereto, a satisfactory show of gas-stoves and other gas appliances and advertisements. In consideration thereof, and subject to the provisions hereinafter contained, the Company will allow the Ironmongers a special discount of 10 per cent. on the amounts due from the Ironmongers to the Company for gas supplied to the ironmongery department: Provided that the gas shall be registered by a separate meter, which shall supply gas to the ironmongery department alone; and provided also that the Ironmongers shall pay to the Company before the 15th day of the month following the rendering of the Company's account for all gas supplied to them, whether in the ironmongery department or elsewhere.

2.—For the purposes of this agreement, the Chief Inspector of the Company, or any person appointed by him for the purpose, shall be the sole judge as to what shall be considered the ironmongery department of the shop or shops, and also as to what shall be considered a satisfactory show of gas-stoves and other gas appliances and advertisements, and what shall be the position of the show in the ironmongery department; and the Ironmongers hereby specially agree that the decision of such Chief Inspector or his nominee shall be final.

3.—The Company will allow to the Ironmongers a special discount of 10 per cent. upon the net cost of all stoves purchased by them from the Company for supply to a consumer within the Company's district, provided that the amount due to the Company for all stoves so purchased shall be paid before the 15th day of the month following the month during which such stoves were delivered to the Ironmongers. For the purpose of this agreement, the net cost shall be the maker's list price less the usual trade discount, provided that such usual trade discount shall actually have been allowed to the Company.

4.—The Company will during the continuance of this agreement allow to the Ironmongers one commission of 7½ per cent. on the net cost of every stove let by the Company on the hire-purchase system in response to any application by the consumer forwarded to the Company by the Ironmongers.

5.—The Company will during the continuance of this agreement pay to the Ironmongers one commission of 5 per cent. upon the net cost of every stove let on hire by the Company through the instrumentality of the Ironmongers, and in response to an application forwarded to the Company.

6.—The Company shall not be bound to accept or comply with any application for a stove or stoves received under clauses 4 or 5 hereof, but shall be at liberty to reject such applications or any of them at their absolute discretion, and without furnishing any reason for such rejection. No commission shall be payable to the Ironmongers in respect of any application rejected by the Company, nor shall they be entitled to any compensation for commission which but for such rejection they would or might have received.

7.—The Company shall supply to the Ironmongers free of cost the circulars, posters, and other literature constituting the advertisements referred to in this agreement.

8.—Nothing in this agreement contained shall constitute the Ironmongers agents of the Company for any purpose whatever except that of introducing persons requiring stoves to the Company; and the Ironmongers hereby expressly agree that they will not hold themselves out, nor allow themselves to be held out or considered, to be agents of the Company, except for the purpose aforesaid. They also expressly acknowledge that they are not

in any way agents for the Company, except for the purpose of forwarding applications to them.

9.—It is expressly agreed that in the construction of this agreement time shall be regarded as being of the essence of the contract, and that the discounts referred to in clauses 3, 4, and 5 hereof shall not be payable except upon the strict observance of the punctual payments upon which they are conditional.

10.—Either party hereto shall be at liberty to terminate this agreement by one calendar month's notice in writing.

Dated this day of one thousand nine hundred and

Witness

Upon this scheme our contemporary made the following remarks :—

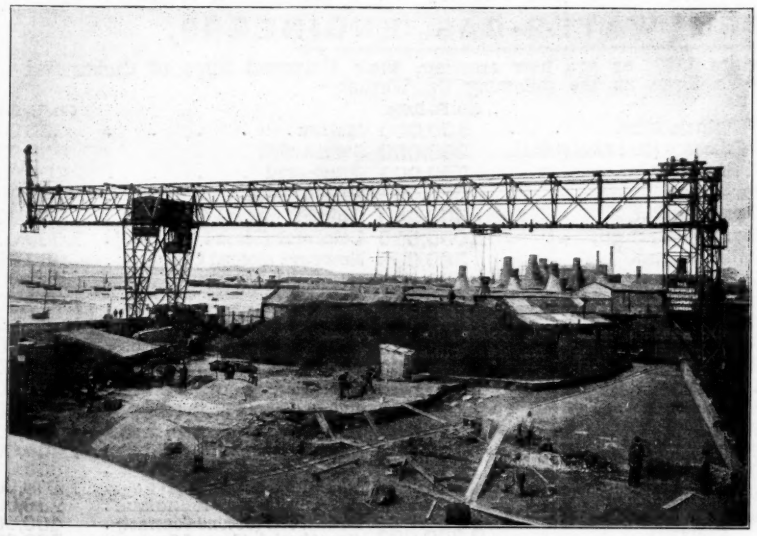
What the Company Propose—From the foregoing it will be clear that an important development is before the hardware trade of London. It is a commonplace that at the beginning of the gas cooking revolution the ironmonger, by his supiness, allowed a very big business to slip from his grasp. Instead of recognizing that the fault lay at his own door, he has shown a decided tendency from time to time to blame the gas companies, who, after all, had no particular desire to do business in gas stoves and cookers, but were determined to make the public realize that they had something to sell which could be placed in competition with coal for heating and cooking. The state of affairs which had existed up to the time of the Gas Exhibition in December, 1904, might have continued indefinitely, but at that juncture it became evident that a new force had entered into the hardware life of the Metropolis ; and the Gaslight and Coke Company, who are the largest producers of gas in London, showed themselves willing to recognize the federation movement. The conference was held during that exhibition ; and since then matters have been maturing slowly, with the result that the circular-letters here printed are in the hands of the trade. The terms of the agreement are so explicit that it is hardly necessary to comment upon them. The offer appears to us to be generous. We can well understand that the gas companies have found it necessary to include the clause allowing them to terminate the arrangement with any ironmonger at a month's notice ; for, obviously, unless the ironmonger can help the companies to increase their sales of gas in a material way, it will not pay them to supply him with gas at a reduction so substantial as 10 per cent.

How the Profits Work Out.—With respect to clause 3, we understand that the Company will interpret this in a very elastic fashion. Any ironmongers with whom they may enter into an agreement will be at liberty to stock the stoves of any maker recognized by the Company, and the list is by no means a restricted one. They will be free to buy from the makers at whatever terms they can make, or, failing that, at 10 per cent. off the net cost represented by the discounts ordinarily offered by the manufacturers to the retail trade. This, we believe, is 30 or 33⅓ per cent. To take a concrete case, if a stove lists at £6 and the manufacturer's discount brings the net cost down to £4, the Company's quotation to the ironmonger will be £3 12s. As to the selling prices, we believe, the Gaslight and Coke Company allow purchasers for cash 25 per cent. discount ; so that in this case the ironmonger could quote the Gas Company's prices, and still secure 20 per cent. profit on the transaction. He would have also, of course, the opportunity of increasing the value of the transaction by securing the fixing of the stoves. In the event of an ironmonger not having in stock the particular stove required, he will be a liberty to accompany his customer to the Company's show-room, if the sale can only be effected after the inspection and examination by the would-be purchaser.

No Liability in Respect of Hire-Purchase.—With regard to the hire-purchase and hiring clauses, the responsibility of the ironmonger terminates with the introduction. If the business is carried through, he draws his commission and hears no more about the matter, as the Company undertake to collect the instalments or rent as at present. Although the conference last Thursday was called by Mr. R. H. Smith acting in conjunction with the London Ironmongers Association, it is not the intention of the Company to accept solely as agents in this respect ironmongers who are associated with the federation movement. The area served by the Company is already divided, for purposes of organization, into about eighty districts, in which there are eight showrooms. The inspectors in charge of each of these districts have, we believe, submitted the names of two or three firms of good standing interested in the gas-fitting trade ; and it was to these firms that the invitations to attend the conference were sent out. The proposals are necessarily somewhat in the nature of an experiment ; and possibly only a limited number of agreements will be entered upon at the outset. We understand, however, that the Company do not intend to make any arrangement an exclusive one in any district. If experience shows that the departure is based on sound business lines, applications from others interested in the supply and fixing of gas fires and stoves would be entertained.

The Comprehensiveness of the Word "Stoves."—It will be noticed from the circular and agreement that the word "stoves" is used throughout. This is intentional, as the proposal will cover not only cookers, but gas-fires and domestic hot-water apparatus, for which there is a growing demand. Besides, there is no reason why ironmongers should not push the sale and use of other gas apparatus employed in industrial processes—as, for example, ironing-stoves and other laundry appliances. On the question of what is to be deemed an adequate display, we learn that the Company do not propose to lay down any hard-and-fast rule. As we have already indicated, all that they have in view is seriously to interest the ironmonger in the supply of apparatus which will lead to the increased use of their speciality—gas ; and in order to accomplish this, they are ready to meet him personally in the matter of his own gas consumption, and in his business capacity as middleman, by according him special terms for apparatus, which they will be prepared to supply at short notice, and this without tying his hands in any way in respect of his dealings with the manufacturer. Furthermore, they will do their best to help him in his relations with the public by providing him with literature calculated to induce the public to use

TEMPERLEY TRANSPORTERS



Temperley Patent Grab Transporter at the Bournemouth Gas and Water Company's New Works, Poole Harbour. Length of Transporter, 272 feet.

For the

RAPID AND ECONOMICAL

HANDLING OF COAL & COKE

AT

Gas - Works, Electricity Generating Stations, &c.,

BY MEANS OF GRABS OR PATENT AUTOMATIC DUMPING BUCKETS.

Temperley Transporter Co.

72, Bishopsgate Street Within,

LONDON, E.C.

Telephone : 365 LONDON WALL.
Telegrams : TRANSUMO, LONDON.

NO BREAKAGE OF COKE if you use Temperley Transporters.

gas-stoves. That there is ample room for missionary work in this direction, is proved by the extraordinary increase in the number of stoves supplied by the Company. We understand that the growth during the past few years has been at the rate of many thousands per annum.

The meeting was held at Armfield's Hotel, under the presidency of Mr. A. Pond; and it was very well attended. In the course of the preliminary proceedings, Mr. Smith explained that they had not assembled to criticize the scheme, which could not be altered, but to ask questions on any obscure points in it. Mr. Goodenough, the Company's representative, had come expressly to clear up any doubts. A number of questions were then put to Mr. Goodenough, whose answers furnished a great deal of information to the meeting. He concluded by stating that he proposed to put everything in train at once, and he thought contracts might be concluded so as to come into force on the 1st of October. He asked to be empowered to put into the agreement a clause making the giving of "tips" to the Company's workmen a cause for terminating it; and the meeting at once agreed that this was most desirable.

GAS v. ELECTRICITY AT MALTON.

The Northern Counties Electricity Company are struggling hard to gain a footing in Malton and Norton, and are fighting the local Gas Company very closely. As stated in a previous issue of the "JOURNAL," they have secured the contract for the lighting of the streets at Malton, but in Norton the Urban District Council on Monday last week accepted the tender of the Gas Company for three years; it being about £12 lower than that of the electricity people. On the other hand, a Committee recommended the acceptance of the tender of the latter for pumping water by electricity at the public water-works—a contract the Gas Company had held for ten years past. From facts that have come to the knowledge of our local correspondent, it seems that the Electricity Company are charging the tradesmen in Norton 2d. per unit for motive power; but, in order to secure the Council's pumping contract, they put their tender at 1½d. per unit, with the further stipulation that the whole cost of pumping, &c., should not exceed £100 per annum. The Gas Company's tender slightly exceeded this; but in the specification there were different terms as to the provision and maintenance of plant, &c. "How far this cutting process is to be pursued," writes our correspondent, "one cannot say; but the Malton Board of Guardians recently evinced a desire to take a share in the proceedings, which really seem to be initiated by two gentlemen who are on both the Council and the Board of Guardians. These had sat on the last commission of inquiry at the Workhouse, and they had found that the cost of gas for lighting and cooking in that establishment had ranged from £125 14s. 10d. in 1903 to an average of £72 1s. in 1906. And yet they recommended that tenders for 'lighting' by electricity be asked for as well! The electricity people have introduced the penny-in-the-slot system among the smaller occupiers at Norton; but, so far, private consumers are not numerous in either Malton or Norton."

DROITWICH GAS UNDERTAKING.

The Manager of the Droitwich Gas-Works (Mr. S. G. Askew) has presented to the Lighting Committee his financial statement and working results in connection with the undertaking for the year to March 31.

The gas made during the year was 17,950,000 cubic feet, an increase of 270,200 cubic feet. The total quantity sold was 13,696,000 cubic feet, a decrease of 67,000 cubic feet. The amount sold by ordinary meters was 12,220,100 cubic feet, a decrease of 256,100 cubic feet; and by prepayment meters, 1,475,900 cubic feet, an increase of 189,100 cubic feet, or 12·8 per cent. The gas consumed in the public lamps exhibits an advance of 39,700 cubic feet; while the unaccounted-for gas is 1½ per cent. more. The amount of coal used was 1701 tons. Though more gas was made, the cost of coal is about £13 less. This is due to the reduced cost and improved make per ton—10,559 cubic feet against 10,443 feet last year. The residuals returns show some improvement on last year; the following being the increased sales per ton of coal carbonized: Coke, ½ cwt.; tar, 1 gallon; and sulphate, 2½ lbs. The amount realized for residuals is 51·6 per cent. of the cost of coal, an increase of 2 per cent. There are 294 ordinary consumers, a decrease of 4; and 126 prepayment meter users, an increase of 20. There are 176 cookers out on hire.

The revenue account shows a slightly additional expenditure. Depreciation (£178) is calculated on the basis adopted by the Committee two years ago—1 per cent. on plant, &c., 7½ per cent. on meters, and 12½ per cent. on stoves. Working expenses generally exhibit a slight decrease as compared with last year. The receipts amount to £3547, a decrease of £32. Residuals show an increase of about £13, though the prices received were slightly less than last year. The gross profit, after allowing the £178 for depreciation, amounts to £1135, from which the following payments have been made: Interest on loans, £213; repayments of principal, £560; and additions to plant, £206. This leaves a net profit of £156. Repayments of principal and additions to plant exceeded those of last year by £28 and £52 respectively; otherwise the net profit would have been improved to this extent.

Water Famine in Lancashire.—The lack of rain in South Lancashire of late has seriously reduced the available supply of water in many reservoirs connected with collieries, cotton mills, and foundries in Manchester and the neighbourhood. It is feared that unless there is soon a heavy fall of rain, many industrial works will be compelled to cease operations.

CARBURETTED WATER-GAS APPARATUS

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Winnipeg, Man.	500,000	Malton	150,000
Windsor St. Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Smethwick	500,000
Saltley Works, Birmingham	2,000,000	York	750,000	Gravesend	300,000
Colchester	300,000	Rochester	500,000	Pernambuco, Brazil	125,000
Birkenhead	2,250,000	Kingston, Ont.	300,000	Duluth, (Second Contract)	300,000
Swindon (New Swindon Gas Co.)	120,000	Crystal Palace District	2,000,000	Leicester (Second Contract)	1,000,000
Saltley, Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Newport (Second Contract)	250,000
Windsor St., Birmingham (Second Contract)	2,000,000	Caterham	150,000	Brockville	250,000
Halifax	1,000,000	Leicester	2,000,000	Toronto (Third Contract)	750,000
Toronto	250,000	Enschede, Holland	150,000	Montreal, Ont. (Second Con.)	1,800,000
Ottawa	250,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Fourth Contract)	1,000,000
Lindsay (Remodelled)	125,000	Burnley	1,500,000	Hamilton, Ont.	400,000
Montreal	500,000	Kingston-on-Thames	1,750,000	Rochester (Third Contract)	1,600,000
Toronto (2nd Cont., Remodelled)	2,000,000	Accrington	500,000	Leeds (Second Contract)	900,000
Belleville	250,000	Tonbridge	300,000	Buenos Ayres (Primitiva Co.)	1,200,000
Ottawa (Second Contract)	250,000	Stretford	500,000	Buenos Ayres (New Co.)	1,200,000
Brantford (Remodelled)	200,000	Oldbury	300,000	Christchurch, N.Z.	300,000
St. Catherines (Remodelled)	250,000	Todmorden	500,000	Rochdale	1,600,000
Kingston, Pa.	125,000	Saltley, Birmingham (Third Contract)	2,000,000	St. John's, Newfoundland	250,000
Peterborough, Ont.	250,000	York (Second Contract)	750,000	Brantford (Second Contract)	400,000
Wilkesbarre, Pa.	750,000	Rochester (Second Contract)	500,000	Smethwick (Second Contract)	500,000
St. Catherines (Second Cont.)	250,000	Newport (Mon.)	250,000	Pontypridd	250,000
Buffalo, N.Y.	2,000,000	Tokio, Japan	1,000,000	Montreal (Third Contract)	1,800,000
		Newcastle-on-Tyne	1,800,000	Guelph, Ont.	350,000
		Leeds	1,800,000	Buenos Ayres (River Plate Co.) Second Contract	750,000
				Belgrano (River Plate Co.)	500,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG,

RURAL WATER SUPPLIES.

At the recent Congress of the Royal Sanitary Institute at Bristol, a paper on the above subject was read by Dr. E. F. WILLOUGHBY in the Engineering Section.

The author first dealt with the law on the subject, and then passed on to refer to the inadequacy of the water supplies in many places. He stated that there are countless villages in all parts of the country on pervious soils—alluvial, tertiary, chalk, sand, or limestone—where shallow wells yield an abundant and perhaps a constant supply of water. Each cottage had its well, but each had also a privy within a few feet of the well, in more or less pervious soil, so that the liquid soaked downwards into the ground water or else directly into the well. Such pollution, if poured on to the surface of the ground, would, in percolating through the upper soil, undergo complete nitrification. But starting from a point 6 or 10 feet below the surface, where the earth was devoid of bacteria, though clarified, it was not purified, and made all such wells a source of danger. The greatest difficulty was encountered in places where the soil consisted to a depth of from 100 to perhaps 400 feet of dense homogeneous clays, in which there were no water-bearing strata. Here it was necessary to go beyond the immediate vicinity, which neither the owner nor the local authority could do; and the only remedy lay in resort to the County Council, on which rather than the local authority the supreme responsibility should devolve. The County Council should be empowered to authorize or compel the formation of Water Boards for the supply of combined districts devoid of means of supplying themselves. Shallow wells would always be a source of water for a large part of the population; and if cesspits were abolished and the wells raised 12 or 18 inches above the ground-level, so as to prevent the entrance of surface drainage, &c., there was no reason why they should not be perfectly safe.

Mr. W. WHITAKER, F.R.S., in opening the discussion, said the great difficulty in connection with water supplies was want of money. It was comparatively easy to devise a scheme for a large city, where a few thousand pounds more or less did not matter, but a very different thing in a rural district, where the rateable value was low. In many cases they must be content with shallow wells; and he agreed with the author that they might be made very good. If they were built up somewhat from the surrounding ground, a great deal of pollution would be avoided. What could be done in rural districts was for several villages close together to combine to get a supply of water. One source was the rain, and the rain water was not bad. It was not always pleasant to drink; but it was wholesome, and it was certainly far better than a pond supply.

Mr. A. F. SOMERVILLE (Wells) pointed out that a great grievance with rural districts was that large cities came and took their supplies from a country district and drained the whole area. If the present law was enforced by the Local Government Board, a great many of the difficulties from which rural districts suffered would be avoided. He had provided cottages with a rain-water supply by having a tank over the door which served also as a porch, and there had been no difficulty at all.

Miss COCHRANE suggested that the provision of rural water supplies should be placed in the hands either of County Councils or a State Department.

After some further discussion,

The CHAIRMAN (Mr. Cotterell) said that rural authorities were quite alive to the necessity of improving the water supplies of their districts, and such discussions as that which had just taken place must be a help to the community. The fact that the death-rate in the country was higher than that of the towns was no doubt due to the water supply. If more powers were given to the County Councils and more energy shown by those who had to do with the health of the community, he thought the health of country districts would be much improved.

Dr. WILLOUGHBY, in reply, expressed his view that deep wells were more in danger from percolation than shallow ones. A deep chalk well within his knowledge was one of the most suspicious he knew of. It was the percolation through fissures at great depth that was dangerous.

Opening Streets by Gas and Other Companies.

A circular letter on the above subject has been sent by the London County Council to the various Metropolitan Borough Councils. They point out that in 1902 and 1903 they had under consideration the question of the inconvenience caused by the breaking up of streets in London by companies and others having statutory rights to do so. In the last-named year, however, it appeared that the question would be considered by the Royal Commission on London Traffic; and, so far as the Council were concerned, the matter remained in abeyance. The Commissioners have since issued their report, in which they lay great stress upon the inconvenience arising from the present state of affairs, and urge the necessity of measures being taken with a view to providing a remedy. The Highways Committee of the Council have again given careful consideration to the matter, and are of opinion that great advantages would result if arrangements could be made for works carried out by different authorities having powers to break up streets to be as far as possible executed simultaneously at certain times of the year. The Clerk has accordingly been directed to inquire whether, in the event of the Council agreeing to promote legislation to enable them to make regulations to govern the breaking up of streets, with a view to securing that, in the execution of such works, regard should be had to the convenience of the public from the point of view of the user of the streets for general purposes, the economy of space in the subsoil of the streets, and other matters affecting the public interest, the Borough Council addressed would be prepared to support the County Council in their application.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Having passed through another "season of refreshing" at the annual meeting of the North British Association of Gas Managers, we are in a position to look back upon it, and to weigh it up; and it must be said that the resolutions of the meeting are, in the main, pleasurable. There was nothing in the technical part of the proceedings upon which anyone could express a dissentient note. In the general business, it is possible to express a mild dissent—always bearing in mind, however, that those in authority are the best judges as to what is, or is not, expedient in the interests of the Association. I refer more particularly to the proposal to change the name of the Association, which was sprung upon the meeting. Keeping in mind the proviso I have already mentioned, I have endeavoured to find a reason for the Committee bringing forward the proposal, and asking for it to be carried into immediate effect. I can think of none, except it were that it was supposed to be necessary to adopt a measure of protection against some influence from the outside which was considered might have a prejudicial bearing upon the interests of the Association. On the assumption that this was really the case, that influence is only to be found in fancied, or it may be real, advances on the part of the Institution of Gas Engineers, with a view to securing the entrance of the North British Association into the ranks of the larger body. Was there any inkling of a set in this direction in England? There may have been such—unofficial, of course, but sufficient to lead to the rushing of a counter movement in Scotland, to preserve the present state of matters. If there were no apprehensions, what was the reason for seeking to force the pace, in a matter which could well have otherwise been taken with the leisure that is generally credited with a tendency to produce fully matured propositions? We who are outside cannot tell. There may have been; and some colour is lent to the view by the unusual rush of kindred Associations in England to get into touch with the North British Association. Whatever may have been the occasion of the proposal being brought forward with the authority of the Committee, the members took a more sober view of the matter, and decreed that time should be taken to look at it more closely—the Committee not objecting, probably from the consciousness that, in airing the subject, they have exhibited their resolution to cry "Hands off." Next year's meeting may approve of a change; and if so, they will do it with their eyes open, and with a full knowledge of the consequences. Should they reject it, there will be no necessity for regarding the proposal as being what Mr. J. Napier Myers termed "wantonly bad," because by that time circumstances may have so changed that there will be no need to make an alteration. The proposal put forward by Mr. L. Hislop, that a Commercial Section be formed, has also been shelved, which, it stands to reason, was the only course possible. Any such movement must rest upon an approved scheme; and there was no scheme of any sort before the meeting—only an abstract resolution, which, even if it had been adopted, must have led to a remit to someone to formulate as to ways and means, as well as methods. The last proposal of the day—that something be done to perpetuate the memory of the late Mr. James M'Gilchrist—was carried with unanimity, and even with cordiality, as was to have been expected. Mr. M'Gilchrist's memory is worthy of commemoration; but, I should say, let the thing not be overdone. Eschew ambitious schemes, which would be burdensome upon the members of the Association and their friends, and which would not be one whit more expressive, if as much so, as some simple but tangible memorial, which would be before the members at their annual gatherings, and would thus be a constant reminder of the great heartedness of the man who was so unwearied for many years in his devotion to gas interests. If any words of mine should have weight with the Committee, I should say that, as the Informal Meeting of Gas Managers was the creation of Mr. M'Gilchrist, it might be well for them not to decide upon any form of memorial until after the Informal Meeting next April; and then a joint scheme might be gone on with.

The technical matter put before the members was of the best—surpassing that of many of the years which have been regarded as good. Particular reference ought to be made to the paper by Mr. W. R. Herring, in respect that it brought into prominence a new line of thought in connection with the problem of effective lighting; and where the matter is more particularly noteworthy is in the fact that it is the result, not of speculation, but of plodding investigation. It is a discovery in the lighting world, which could not have emerged until the advent of the incandescent burner, but which will now, notwithstanding that it is not thoroughly understood, be helpful to managers in the promotion of lighting by means of the incandescent burner. The meeting, generally, was an enjoyable one, as well as profitable. Mr. W. B. M'Lusky gave a very thoughtful address. He is incapable of doing otherwise, for there is not a corner in the whole gas world which he has not applied his mind to. The duties of the Chair were not heavy, but they were discharged with tact and judgment. It is gratifying to find the membership of the Association increasing, and matters prospering generally with them. This year the after-proceedings were of more than usual interest, on account of the last item being a visit to the Granton Gas-Works of the Edinburgh and Leith Corporations. The weather broke down shortly after the company arrived in the works, and heavy rain rather hampered movement; but sufficient was seen to warrant the expression of opinion that, for situation and general appearance, the works are incomparable, at all events, within the United Kingdom. Their position as a potentiality in the world of gas making is established by the working results obtained from them—I speak of what strikes the person whose soul is not altogether devoid of a love of the beautiful and the fanciful. The artistic way the yard has been laid out, the myriads of young trees which have been planted lending a charm to them, and the spacious nature of the buildings, make the visitor feel that he is in the grounds of some lordly mansion, instead of being in the precincts of a busy factory out of which a revenue of £300,000

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a year is earned. In their æsthetic setting, the works certainly maintain the reputation the citizens of Edinburgh are so keenly alive to—of theirs being a place where the amenities are carefully fostered.

I learn that the Committee of the Waverley Association of Gas Managers have, under the powers conferred upon them at the meeting of the Association in Peebles last April, resolved that there is to be only one meeting of the Association yearly; the spring meeting being the one to be retained. There will, therefore, be no meeting this autumn. The gathering next spring will be held in Edinburgh.

It is announced that the De Laitte gaslight has been installed for the lighting of Bishopton Railway Station, on the Caledonian Railway, between Paisley and Port Glasgow. The light is described as an entirely new one in this country. At Bishopton, thirty lights have been fitted up. The light emitted is said to be between 50 and 60 candles, and the cost of the gas to be about 1s. per 1000 cubic feet. In the apparatus petrol is mixed with air; the combination forming a gas which is led through pipes to the incandescent mantle in the usual way. There is always a reserve of exactly 1 cubic foot of gas; the wastage by burning being automatically made good by the apparatus. The gas is non-poisonous; and being four times heavier than air, sinks to the ground whenever any of it escapes. It is almost odourless, and will not explode, so that there is claimed to be no danger in using it. The only attention necessary is the occasional winding up of the weights by which the apparatus is regulated, and the opening of the taps when the light is turned on. It is claimed that the apparatus produces 1000 cubic feet of gas from a gallon of petrol, and that it is the cheapest of all illuminating gases. This description is borrowed from a newspaper report. So far as can be seen, the process belongs to the family of which the Notkin is the patented parent, but which has not attained the success its promoters anticipated of it some six years ago.

The Bo'ness Gaslight Company, Limited, held their annual general meeting on Monday last—Provost Ballantine in the chair. The report of the Directors showed that the income for the year amounted to £4432, and the expenditure to £3617, which left a balance of £815. Adding £199 brought forward from the previous year, there was a sum available for distribution of £1014. The Directors recommended a dividend of 5 per cent., which would absorb £706, and that the balance be carried forward. This was agreed to. It was pointed out that last winter the streets of the town through which cables have been laid were lighted by electricity. This had the effect, to some extent, of reducing the consumption of gas and the receipts; but it had in no way interfered with the profits of the Company. The Chairman and other Directors expressed satisfaction with the way things had turned out.

Stealing Gas-Fittings.—At the County of London Sessions, Thomas Platt and Edward Pink pleaded guilty to stealing gas brackets and other fittings, the property of the Gaslight and Coke Company. It was stated that the prisoners were two of a gang of six who went about Homerton and Hackney wrecking houses. Pink was ordered fifteen and Platt nine months' hard labour.

CURRENT SALES OF GAS PRODUCTS.

Week ending July 28.

The London market for coal tar products has been rather brisker during the past week. A considerable business has been done in ordinary London creosote at prices ranging from 2⅜d. to 2½d. naked at makers' works. There has been little movement in pitch; but the tone is, if anything, firmer. There seems to be no alteration in 60° crude acid, which stands at 1s. 9d. per gallon net f.o.b. Benzol, 90 per cent., has been more active, and 10d. per gallon net has been paid, and 10½d. is now being asked. Sulphate of ammonia is also better; for whereas it was reported quite recently that £11 15s. had been accepted for prompt, £11 18s. 9d. has now been paid on the same terms, and all round there is greater firmness.

LIVERPOOL, *July* 28.

Sulphate of Ammonia.

Demand has been sustained, mainly for covering contracts for July delivery, but without any appreciable alteration in values, the closing quotations being still £11 12s. 6d. per ton f.o.b. Hull, and £11 15s. per ton f.o.b. Liverpool and Leith. Direct orders have again been rather scarce, although there has been a fair amount of inquiry. Interest in the forward position has been maintained, but while speculators have been paying a premium, varying according to position, direct buyers' ideas are as yet scarcely above spot prices. For October-December delivery, business has been done at £12, and for October-March £12 2s. 6d. per ton delivered f.o.b.

Nitrate of Soda.

This article remains very firm, spot prices being 11s. 1½d. and 11s. 4½d. per cwt. for 95 per cent. and refined qualities respectively.

LONDON, *July* 30.

Tar Products.

The market for tar products has been quiet, but firm. Pitch remains in about the same position. It is reported that 26s. has been paid at an out of the way port on the east coast for prompt delivery; while even lower prices have been accepted on the west. For forward delivery, however, makers are firm in their ideas. The principal London Gas Company maintain their quotation at 32s.; but it is impossible to obtain this price, and a firm offer of 30s. would probably be accepted by other manufacturers. There is a slight demand from South Wales; and business is reported to have been done at low prices for the last few months of the year. Buyers in this district are anxious to cover themselves for January-June, but at present distillers are not inclined to sell so far forward. In creosote, the market remains in about the same position. London makers are still unwilling to sell except at good prices, owing to the very good demand existing for

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export to America. Midland makers are willing to sell salty oil at about 1½d. at their works; but for liquid, 1⅝d. to 1¾d. is asked. There is no change in anthracene. Consumers do not appear willing to pay more than 1½d. per unit for "A" quality; and from time to time they secure small quantities at this price. The value of solvent naphtha is unchanged. London makers are fairly well sold, and not inclined for further business except at good prices. It is reported that 1s. 2½d. has been paid at Station London for a fair quantity for prompt delivery; but makers still seem willing to sell for delivery all over next year at existing prices. Carbolic acid is unchanged. Continental consumers refuse to pay more than 1s. 9d. on the east coast; but it is quite impossible to get manufacturers to entertain this price. It is reported that 1s. 9½d. has been paid for delivery up to the end of the year, evidently to cover sales made some little time ago. The market for crystals is quiet, and prices remain nominal at 6d. for 39-40 per cent., and 5¾d. for 34-35 per cent.; but no business is reported in the article. In toluol, London makers ask 1s. 2d. for any small quantities which they may be in a position to deliver. Manufacturers in the Midlands are willing to sell at about 1s. 0½d. at their works; but they cannot secure this price. Benzol, 90 per cent., is quiet, and an offer of 7d. naked at makers' works in the North for January-March delivery was refused. This price, however, has been accepted for delivery to the end of the year. 50-90 per cent. continues firm, and there is very little offering.

The average values during the week were: Tar, 15s. to 20s. Pitch, London, 27s. 6d.; east coast, 26s. to 26s. 6d.; west coast, 25s. 3d. to 25s. 9d. Benzol, 90 per cent., 9½d. to 9¾d.; 50-90 per cent., 10⅜d. to 11d. Toluol, 1s. 1½d. to 1s. 2d. Crude naphtha, 3¾d. to 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 2d.; heavy naphtha, 11½d. to 1s. 0½d. Creosote, London, 2d.; North, 1½d. to 1⅝d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9d. to 1s. 9½d. Naphthalene, £4 10s. to £9 10s.; salts, 25s. to 27s. 6d. Anthracene, "A" quality, 1½d. to 1¾d. "B" quality, nominal.

Sulphate of Ammonia.

The market for this article has been exceedingly firm during the past week, especially for forward delivery. The principal London Gas Company now quote £12 10s. for January-April delivery; and good prices are reported to have been offered for ordinary London stuff for forward delivery. For prompt, the value may be taken as £11 12s. 6d. to £11 15s.; but there is practically nothing offering. In Hull, £11 12s. 6d. has been offered and refused for prompt delivery; and £12 2s. 6d. has been offered and declined for January-April. In Leith, it is reported that £12 5s. has been offered and refused for the same period; while the ruling value for prompt is about £11 17s. 6d. In Liverpool also £12 2s. 6d. has been offered and refused for January-April; and the prompt price may be taken as £11 15s. to £11 17s. 6d. The market closes firm all round; and there is little doubt that dealers are anxious to buy for forward delivery.

COAL TRADE REPORTS.

Lancashire Coal Trade.

It is difficult to find anything new to say with regard to the Lancashire coal trade, which is being carried on just to meet present requirements. There is no briskness about it. Fortunately the cotton and machinery trades are fully employed; and for power purposes of all kinds coal is indispensable. This keeps our colliers fairly at work. House coal is being stacked for winter consumption. Gas coal and cannel are moving off slowly, with ample reserves. Shipping coal is in moderate demand. The average quotations per ton, at the pits, are: Best house coal 12s. to 14s., secondary 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel 7s. 6d. to 8s. 6d., best slack 6s. 9d. to 7s. 6d., medium 6s. to 7s., and common 5s. to 6s. Coal for shipping on the Manchester Ship Canal is 9s. 6d. to 10s. 6d.

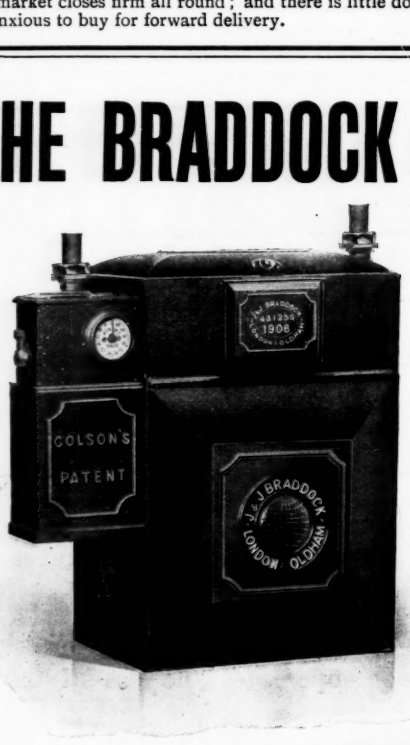
Northern Coal Trade.

There is activity in the coal trade of the North-east; and though the output of some of the collieries is a little restricted through local holidays, the production is fair on the whole. Prices are firmly maintained generally. In the steam coal trade, the exports are full; and best Northumbrian steams are from 10s. 6d. to 10s. 9d. per ton f.o.b. Second-class steams are steady at from 9s. 9d. to 10s., while steam smalls are firm at 6s. to 6s. 3d. As to the gas coal trade, the brisk demand is above that which is usual at this time of the year, when the consumption is only limited in general. Shipments are increasing on the long contracts; and there is a fair export demand. Durham gas coals vary from about 9s. 6d. to 10s. 6d. per ton f.o.b., according to the quality and the period of delivery—forward delivery giving a higher quotation in price, more especially for the very best kinds of gas coal. There are no contracts of importance reported during the last few days. In the coke trade, there is a steady inquiry; but gas coke is beginning to increase in the extent of the production, so that supplies are more plentiful. Prices have not altered; good gas coke being quoted from 10s. to 10s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Work having now been generally resumed by the miners, there is more activity in the market. Stocks are low; and, following this state of matters, there is a disposition on the part of coalowners to stiffen prices for forward delivery. The prices quoted are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 9d. to 10s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 173,936 tons, a decrease of 104,994 tons upon the previous week, but an increase of 134,245 tons upon the same week of last year. For the year to date, the total shipments have been 7,399,869 tons—an increase of 844,098 tons upon the corresponding period of 1905.

THE BRADDOCK PATENT "SLOT" METER



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J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

Cardiff Street Lighting.

In a report submitted by the City Engineer of Cardiff (Mr. Harpur) to the Lighting Committee, regarding the cost of incandescent and flat-flame lighting under the new scale of charges offered by the Gas Company, he pointed out that the Gas Company, under their new Act, had power to reduce their illuminating power from 16 to 14 candles; but they offered a 70-candle power incandescent lamp at the same cost as the old flat-flame lamps. The Corporation would, however, have to instal the incandescent burners and keep them in efficient repair. The cost of the 70-candle power incandescent lamp would be £3 2s. 9d. per annum. The Committee decided, in streets where the electric mains are not laid, to convert the flat-flame lamps into 70-candle power incandescent lamps; and the Engineer was instructed to prepare an estimate of the cost of conversion, so that applicaton might be made to the Local Government Board for permission to borrow the necessary money. As, however, the Committee already had £250 in hand available for the purpose, it was decided to immediately convert the flat-flame lamps in Frederick Street into incandescent lamps. Mr. Ellis, the Electrical Engineer, told the Committee that for £3 3s. a year he could supply a new type of electric incandescent lamp which gave good results; and, as an experiment, it was determined to put some of these lamps into several streets where electric cables are already laid.

Siding-Rent Charges for Collieries.

The "Iron and Coal Trades Review" says: "The railway companies are extending their sphere of action in regard to siding-rent charges. Having only recently seriously endeavoured to enforce payment from coal merchants and factors, they have now issued circulars to colliery proprietors notifying their intention to charge them siding-rent, after three clear days' occupation, at the rate of 6d. per truck per day. The decision of the companies, who are acting in consort, will not perhaps very seriously affect those pits which have large sidings of their own; but where they are dependent to some extent upon the railway metals in slack times, when there are accumulations of loaded waggons, it will mean that after the colliery sidings are full, work will either have to be regulated in proportion to the number of actual orders coming in, or the new charges will be incurred. The railways intend to demand siding-rent wherever their metals are occupied more than the specified time of three days; but their action is understood to be taken principally with a view to prevent collieries sending on to re-labelling stations, and there keeping free of charge as stock coal, loaded waggons which are really on order by customers, some of whom, it is stated, have thus managed to avoid siding-rent. It is, moreover, declared that the railway companies have been moved to take this action by the arguments of merchants and factors who, when pressed for a settlement, have asked why they should be compelled to pay while colliery trucks occupied sidings free of charge, as they have done in the past."

The Assets of the Devonport Water Company.

In accordance with the provisions of the Devonport Water Act, the scheme for the distribution of the money received by the Company for the purchase of the undertaking has been submitted to Mr. Samuel Wood, of Messrs. Wood, Drew, and Co., to adjudicate upon. The scheme as originally drawn provided that, in regard to the 4 per cent. preference stock, payment should be at the rate of £121 10s. for every £100 of the stock. Objection was taken to this by the Plymouth and Devonport Corporations, both of whom had invested in this stock—purchasing at a higher price than was proposed to be paid under the scheme. Mr. Wood finds that a distinction ought to be drawn between two separate issues of preference stock by the Company. For that which was issued under the Devonport Water Act, 1876, he allows £121 per cent.; while for a second issue under the Company's Act of 1889, he gives £126 per cent. The effect of this will be to decrease the amount divisible among the holders of the ordinary stock; and Mr. Wood gives the price to be paid them as £168 per cent., in place of £173 in the original scheme of distribution. Mr. Wood is expressly named as sole Arbitrator in this matter; and his decision is binding upon all parties. At a meeting of the Finance Committee of the Devonport Corporation on Thursday last, the Chairman (Mr. H. Banbury), referred to the decrease, and said it meant that the Company would have to distribute about £2188 more than was originally intended among the holders of the preference stock. In the case of the Devonport Corporation, the effect would be that they would receive £77 1s. in excess of the sum first allotted them.

Suicide by Gas Poisoning.—A woman named Annie Hartley, aged 54, was lately found by a sister sitting in an armchair in the kitchen with a piece of indiarubber tubing in her mouth. The other end was attached to a gas-bracket on the wall; and the tube was kept in position by a tape round her head. Dr. Marshall, the Divisional Surgeon, who was called to the woman, said she was unconscious, and he could not see any evidence of life. Artificial respiration was kept up for an hour-and-a-half. She died from gas poisoning. The Coroner's Jury returned a verdict of "Suicide while suffering from temporary insanity."

Cumberland Water Schemes.—The Penrith Rural District Council have received a report from Mr. G. R. Strachan regarding the feasibility and cost of two schemes of water supply from the Glenderamackin River, on the northern side of Blencathra, intended to meet the needs of nearly the whole of the western side of the Penrith Union. One plan is to supply only the rural area; while the other is designed as a joint scheme, to be owned by the Penrith Urban Council as well as the Rural Authority. The former Mr. Strachan estimates to cost £35,000; while the rural cost alone of the joint scheme he puts at £44,240, owing to the large expenditure that would be incurred to make storage works on the Glenderamackin. He therefore reports in favour of separate schemes; advising the town to go elsewhere for a supply.

STARTLING DEVELOPMENT.

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WILSONS & MATHIESONS, LTD.,
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Australian Gas Affairs.—The Metropolitan Gas Company of Melbourne have cabled their London Agents (Messrs. John Terry and Co.) that the profits for the half year to June 30 were £54,250; a dividend of 5s. per share has been declared for the six months; a sum of £12,000 has been added to the reserve fund; and the balance of £2250 carried forward.

Public Lighting of Newhaven.—At the last meeting of the Newhaven Urban District Council, the Sanitary and Lighting Committee reported the receipt of a letter from the Gas Company stating that the Directors could not see their way to reduce the price of gas for public lighting below 3s. 9d. per 1000 cubic feet. The Committee recommended the Council to enter into a further agreement for three years if the Gas Company will reduce the price to 3s. 3d. per 1000 cubic feet, "as it was found that other gas companies in less advantageous districts were able to supply gas to private consumers at a rate of 3s. 6d." This was agreed to by the Council.

Gas Preferred at Pudsey.—A Committee of the Pudsey Town Council have had under consideration a proposal of the Yorkshire Electric Power Company to light several of the streets with electricity —as the Company said, "at a cost not exceeding that of gas." When, however, the Committee came to look into the matter, they found that, while the cost of gas-lamps (about £1 6s. 8d. each per season) came to something like £600, the offer of the Electricity Company came to about £7 per lamp, or over £4200 for lighting the town. The Committee therefore recommended the Council to let the proposal drop; and this the Council have unanimously agreed to.

Theft from a Prepayment Meter.—At the Thames Police Court, a few days ago, Andrew Black was charged with stealing 6d. from an automatic gas-meter belonging to the Commercial Gas Company. Nellie Bernstein, a girl living in Ship Alley, Shadwell, stated that about two o'clock last Tuesday she saw the accused coming down the stairs of her father's house, from the direction of the gas-meter, which was fixed on the first floor. Witness informed her father, and on investigation they found the meter open, the lock broken, and the cash-box empty. Two days later witness saw prisoner, and he was arrested. Mr. Mead sentenced him to three months' hard labour.

Geneva Gas Supply.—In the year ending Dec. 31 last, the Municipality of Geneva supplied 8,225,580 cubic metres, or rather more than 290½ million cubic feet, of coal gas, and 1,195,840 cubic metres, or about 42 million cubic feet, of carburetted water gas; making a total of 9,421,420 cubic metres, or 332½ million cubic feet. The charge for gas to private consumers is 22 c. per cubic metre, or at the rate of about 5s. per 1000 cubic feet. The manufacturing and other expenses last year came to 1,418,235 frs. (£56,730); the revenue from the sale of residuals, &c., to 563,620 frs. (£22,545). The net cost of gas per cubic metre was 9·6 c.; interest and sinking fund charges coming to 5 c. The total was consequently 14·6 c. per cubic metre, or 3s. 4d. per 1000 cubic feet out of the 5s. paid by the consumers.

Woodhall Spa Gas Purchase Scheme.—Last Wednesday, a meeting of ratepayers convened by the Woodhall Spa Urban District Council was held to consider the advisability of purchasing for £600 from the Woodhall Spa Gas and Water Company a piece of land and their gas powers. Mr. J. E. Chatterton, the Clerk to the Council, stated that with an annual consumption of 3,600,000 cubic feet, the receipts would be about £756, and the expenses £784. The cost of the proposed works would be £5000. A long discussion took place; and one gentleman expressed the opinion that if the Council took over the Company's gas rights they ought also to have the water rights. The Company wanted to get rid of the unprofitable part and retain the other. Another speaker was of opinion that electric light could be installed for £2500, and that gas would certainly never pay, because the largest ratepayers had already installed the electric light. Eventually it was decided to recommend a postponement of the gas scheme indefinitely.

Conciliation in Labour Disputes.—The annual meeting of the London Labour Conciliation and Arbitration Board was held last Wednesday, in the Council Chamber of the London Chamber of Commerce, Oxford Court, Cannon Street. Sir S. B. Boulton presided; and about 60 delegates were present. The Chairman moved the adoption of the fifteenth annual report of the Board, which stated that since 1899 there had been a steady and consistent decline in the number of reported labour disputes, and that this very satisfactory trend of affairs was, no doubt, contributed to by the work of various Conciliation Boards in promoting amicable relations between employers and employed. The good offices of the Board were offered in eight cases. The Chairman pointed out that theirs was the only body of its kind which offered its services with a mixed panel of arbitrators, half employers and half workmen; and the principle had been remarkably successful. A great step in advance would be recorded when they could get public bodies to resort to Conciliation Boards. He was glad to say that the London County Council, having had a dispute with three Trade Unions, had referred the difficulty to the Board. The motion was adopted.

New Joint-Stock Companies.—The Nottingham Gas and Electric Fittings Company, Limited, has been registered with a capital of £1000, in £1 shares, to adopt an agreement with Messrs. W. W. Favell and J. E. Watts for the acquisition of certain businesses lately carried on in Nottingham by Mr. W. W. Favell as "S. Haynes and Co.," and the "Nottingham Gas and Electrical Stores," and by Mr. J. E. Watts as "Watts's Incandescent Depôt." There will be no initial public issue. A Company under the title of F. & C. Osler, Limited, has been registered with a capital of £205,000, in £10 shares (2300 "A" preference and 17,700 "B" preference) to acquire the business carried on as F. & C. Osler, at Birmingham, London, Calcutta, Bombay, and elsewhere, and to carry on the business of manufacturers of, and wholesale and retail dealers in, glass, china, earthenware, and enamel, &c. The Baillieston Gaslight Company was registered in Edinburgh last week. The object is to erect works for the manufacture and supply of gas, and lighting with it the village of Baillieston, in Lanarkshire. The capital is £4573 10s., divided into 3049 shares of £1 10s. each. There is at present a Gas Company in Baillieston, with an annual output of about 10 million cubic feet, and a capital of the same amount as that of the new Company. It is probable, therefore, that the new concern is a continuation of the old one.

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Water-Finding in German South-West Africa.—From an announcement in the "Hamburger Nachrichten," it would appear that believers in the dowsing-rod will find additional evidence in their favour in German South-West Africa. Herr von Uslar, who was sent out to endeavour to locate water supplies, is said to have written home to the effect that on the 21st of June two excellent wells were bored, which his divining-rod had enabled him to discover. It is added that up to the 26th of June he had by the same means discovered water in no fewer than 53 places.

Messrs. D. Y. Stewart and Co., Limited, of Glasgow, are supplying the pipes required for a new water-works system at Monterey, Mexico. The quantity is 4000 tons.

The Salford Gas-Meter Inspector's report, which was presented to the Magistrates last week, showed that in the past year 13,164 meters were tested, and that fees amounting to £409 were received.

The Directors of Messrs. C. & W. Walker, Limited, have declared interim dividends at the rate of 5¼ per cent. per annum on the preference shares, and at the rate of 10 per cent., free of income-tax, on the ordinary shares, for the half year ending to-day.

The Western Valleys (Mon.) Water and Gas Company have recently instructed the Richmond Gas Stove and Meter Company, Limited, to undertake the complete supply and fitting up of automatic installations in their district including cooker, brackets, pendants, George Glover and Co.'s meter, &c.

Tenders for the issue of 700 ordinary shares of the East Surrey Water Company (as recently advertised for in the "JOURNAL") were opened on Friday last. They amounted to 5380 shares, at prices varying from £16 10s. to £17 10s. per share. The average price obtained for the issue is £16 14s. 1d. per share; and no allotment was made under £16 10s.

The annual outing of the officials and employees of the Ventnor Gas and Water Company took place last Wednesday. They were accompanied by the Chairman of the Company (Mr. W. H. Littlefield) and the Engineer and Secretary (Mr. J. S. Ineson). The programme for the day was a drive along the Undercliff, through Chale and Freshwater to Yarmouth. Dinner was provided at the Bugle Hotel. Mr. Ineson gave a short address to the men, and proposed "Success and Prosperity to the Company;" mentioning that the Company were providing and paying the whole cost of the day's enjoyment and full day's pay. The toast was enthusiastically honoured; and Mr. Littlefield responded. Mr. W. R. Maybee proposed a vote of thanks to the Directors and Mr. Ineson for giving them one of the best outings they had ever had. After dinner the men visited the various places of interest. From Yarmouth the party proceeded to Carisbrooke, where tea was partaken of. On returning to Ventnor, hearty cheers were given for Mr. and Mrs. Ineson.

The employees at the Peterhead Gas-Works, accompanied by their friends, held their first outing to Aden on Saturday, the 21st inst., and, favoured with excellent weather, a very enjoyable afternoon was spent in the beautiful grounds of Aden House, kindly placed at the disposal of the party by General Russell. They reached Aden early in the afternoon, and a programme of sports was gone through. At tea they were joined by Bailie Ritchie, the Convener of the Gas Committee, and Mrs. Ritchie. The prizes were afterwards presented by Bailie Ritchie, who expressed the hope that it would not be the last occasion the employees would have an outing; and he trusted that year by year the event would be successful. Their new Manager (Mr. W. Ritchie) had begun very well; and he (Bailie Ritchie) trusted he would long be spared to carry on the work. On the call of Mr. Ritchie, a hearty vote of thanks was accorded to Bailie Ritchie, and a like compliment to the Gas Committee. The arrangements were perfectly carried out by a Committee, with Mr. John Sangster as Secretary.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

REPRESENTATIVE (Gas-Stove Trade). No. 4623.
SUB-MANAGER. Warrington Corporation.
FOREMAN OF WORKS. No. 4628.
GENERAL WORKS FOREMAN. Dunfermline Corporation.

Situations Wanted.

ASSISTANT-MANAGERSHIP. No. 4627.
GAS APPARATUS FIRM. Mr. Rowen, Manchester.
CLERK. No. 4629.

Chemist for Lecturing.

THE UNIVERSITY, SHEFFIELD.

Lead Burning and Sulphate Plant Repairs.

No. 4625.

Plant, &c., for Sale.

CORNISH BOILER AND WELDED STEEL CHIMNEY. Redditch Gas Company.
GASHOLDER. Paignton Gas Company.

Companies Meetings.

BRENTFORD GAS COMPANY. Charing Cross Hotel, Aug. 3, 2.30 o'clock.
BROMLEY GAS CONSUMERS' COMPANY. Bromley, Aug. 9, 6 o'clock.
COMMERCIAL GAS COMPANY. Cannon Street Hotel, Aug. 16, 12 o'clock.
HORNSEY GAS COMPANY. Offices, Aug. 10, 3.30 o'clock.
SOUTH SUBURBAN GAS COMPANY. Albion Tavern, Aug. 10, 3 o'clock.
TOTTENHAM AND EDMONTON GAS COMPANY. Tottenham, Aug. 18, 3.30 o'clock.

Stocks and Shares.

BOURNEMOUTH GAS AND WATER COMPANY. Tenders by Aug. 9.

TENDERS FOR

Coal and Cannel.

ISLE OF THANET GAS COMPANY. Tenders by Aug 23.
SHEFFIELD UNITED GAS LIGHT COMPANY. Tenders by Aug. 8.

Gas Oil.

BIRKENHEAD CORPORATION. Tenders by Aug. 9.

Tar and Liquor.

HEYWOOD CORPORATION. Tenders by Aug. 14.

Lime.

HEYWOOD CORPORATION. Tenders by Aug. 14.

Tubes and Fittings.

HEYWOOD CORPORATION. Tenders by Aug. 14.

Sulphuric Acid.

HEYWOOD CORPORATION. Tenders by Aug. 14.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 293.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
160,000	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	May 11	7	Bomb'ay, Ltd.. . . .	6⅝—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	4⅝—5¼	..	5 6 8
50,000	10	Mch. 9	14	Bourne- mouth Gas & Water } 10 p.c. . . B 7 p.c. . Pref. 6 p.c.	28½—29½	..	4 14 11
51,810	10	,,	7		17—18	..	3 17 9
53,200	10	,,	6		15—16	..	3 15 0
380,000	Stk.	Feb. 22	12½	Brentford Consolidated	263—268	..	4 13 3
300,000	,,	,,	9½	Do. New . . .	200—205	..	4 12 8
50,000	,,	,,	5	Do. 5 p.c. Pref. .	123—128	..	3 16 11
206,250	,,	June 14	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Mch. 9	11½	Brighton & Hove Orig.	230—235	..	4 15 9
246,320	,,	,,	8½	Do. A. Ord. Stk. .	165—170	..	4 17 1
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
100,000	Stk.	Feb. 22	6	Bromley, Ord. 5 p.c. .	121—124	..	4 16 9
165,760	,,	,,	4½	Do. do. 3½ p.c. .	92—95	..	4 14 9
500,000	10	May 11	7	Buenos Ayres (New) Ltd.	11½—12	..	5 16 8
250,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
150,000	20	July 12	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	June 14	10	Cape Town & Dis., Ltd.	15½—16½	..	6 1 3
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	9¾—10¼	..	4 7 10
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	98—100	..	4 10 0
1,443,280	Stk.	Feb. 22	5⅛	Commercial 4 p.c Stk. .	114—116	..	4 9 7
560,000	,,	,,	5	Do. 3½ p.c. do. .	111—113	..	4 8 6
475,000	,,	June 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	123—126	—1	5 3 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
432,070	Stk.	Feb.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	105—107	..	3 14 9
486,090	10	July 27	11	European, Ltd. . . .	24—25*	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18—19*	..	4 6 10
15,223,235	Stk.	Feb. 8	4⅘	Gas- light and Coke } 4 p.c. Ord. . . 3½ p.c. max. . . 4 p.c. Con. Pref. 3 p.c. Con. Deb.	98—100	—2	4 8 0
2,600,000	,,	,,	3½		88—90	..	3 17 9
3,799,735	,,	,,	4		108—111	..	3 12 1
4,193,975	,,	June 14	3		86—88	..	3 8 2
258,740	Stk.	Mch. 9	5	Hastings & St. L. 3½ p.c.	100—105	..	4 15 3
82,500	,,	,,	6½	Do. do. 5 p.c.	121—124	..	5 4 10
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	20—21	..	5 4 9
4,940,000	Stk.	May 11	8	Imperial Continental .	178—180	..	4 8 11
473,600	Stk.	Feb. 8	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 28	6	Lea Bridge Ord. 5 p.c. .	121—126	..	4 15 3
561,000	Stk.	Feb. 22	10	Liverpool United A . .	235—237	..	4 4 5
718,100	Stk.	Feb. 22	7	Liverpool United B .	169—171	..	4 1 10
306,083	,,	June 28	4	L'rpool Unit'd Deb. Stk.	107—109	..	3 13 5
75,000	5	June 28	5	Malta & Medn., Ltd. .	4¼—4½	..	5 5 3
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb..	103—105	..	4 15 3
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	11—12	..	5 16 8
1,675,892	Stk.	Feb. 22	4½	Newc'tle & G'tesh'd Con.	110—112	..	4 2 7
406,625	Stk.	June 29	3¾	Do. 3½ p.c. Deb.	97—99	..	3 10 8
15,000	10	Mch. 9	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
52,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 11	8	Oriental, Ltd. . . .	150—153	..	5 4 7
600,000	5	Mch. 28	7	Ottoman, Ltd. . . .	6—6¼	..	5 7 8
398,490	5	Apl. 26	7	Primitiva Ord. . . .	6⅛—6⅜	..	5 3 8
796,980	5	July 27	5	Do. 5 p.c. Pref. .	5—5¼*	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
851,070	10	Apl. 26	7	River Plate Ord. . . .	12½—13	..	5 7 8
300,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
250,000	10	Mch. 28	8	San Paulo, Ltd. . . .	14—14½	+¼	5 10 4
70,000	50	July 2	5	Do. 5 p.c. Deb. .	49—51	..	4 18 0
135,000	Stk.	Mch. 28	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,498	,,	,,	10	Do. C	243—245	..	4 1 8
126,106	Stk.	Mch. 9	5⅜	Shrewsbury Ord. 5 p.c.	114—116	..	4 14 10
70,000	10	May 31	10	South African	15½—16½	..	6 1 3
6,250,000	Stk.	Feb. 22	5⅜	South Met., 4 p.c. Ord.	132—134	..	4 2 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	86—88	..	3 8 2
575,000	Stk.	Mch. 9	5⅜	S'th Suburb'n Ord. 5 p.c.	124—127	..	4 6 8
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	July 12	5	Do. 5 p.c. Deb. Stk.	130—135	..	3 14 1
502,310	Stk.	May 11	5	Southampton Ord. . .	107—112	..	4 9 3
120,000	Stk.	Mch. 9	6¾	Tottenham A 5 p.c. .	124—127	..	4 18 5
363,020	,,	,,	4¾	and B 3½ p.c. .	99—102	..	4 13 2
137,500	,,	June 28	4	Edmonton 4 p.c. Deb.	103—105	..	3 16 2
182,380	10	June 14	8	Tuscan, Ltd.	10—10½	..	7 12 5
149,900	10	July 2	5	Do. 5 p.c. Deb. Red.	98—101	..	4 19 0
30,000	Stk.	Feb. 22	7½	Wands- A 5 p.c. . .	—	..	—
255,636	,,	,,	6¾	worth B 3½ p.c. . .	133—136	..	4 11 11
75,000	,,	,,	5⅞	and C 3½ p.c. . .	110—113	..	4 16 1
69,416	,,	June 28	3	Putney 3 p.c. Deb. Stk.	82—85	..	3 10 7
745,872	,,	Mch. 9	5⅜	West Ham 5 p.c. Ord. .	106—108	..	4 14 10
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—125	..	4 0 0
193,300	,,	June 28	4	Do. 4 p.c. Deb. Stk.	104—107	..	3 14 9

Prices marked * are "Ex div."

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

BANK HOLIDAY.

In consequence of the BANK HOLIDAY (Aug. 6), Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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Correspondence invited.

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OVER 3000 INSTALLATIONS IN DAILY USE.
SEE illustrated advertisement in next week's issue.
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SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
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GAZINE—A radical Solvent and Preventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, West Moor Chemical Works, Killingworth, near NEWCASTLE-ON-TYNE.

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PAINTING Work for all kinds of Gas-Works Plant, Roofs, Bridges, &c., undertaken by Contract or otherwise.
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We guarantee promptness, with efficiency for Repairs.
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Best Prices paid.
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Ouse Chemical Works, SELBY.

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Telephones: 254 Oldham, and 2412 HOP, London.
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BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

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MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
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Address No. 4629, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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THE Engineer of large Provincial Gas-Works desires to recommend fully qualified young Man as Assistant in a Provincial Works. Would prove a sensible and diligent helper.
Address No. 4627, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MR. E. G. ROWEN, 148, Princes Road, Moss Side, MANCHESTER, many years with the Davis Gas Stove Company, is open for an appointment with a first-class Firm. Large experience and good Connection in the North of England. Cookers, Heating-Stoves, Fittings, or Tubes.

LARGE Gas-Stove Firm require First-Class Man with Experience to REPRESENT them in Scotland and North of England.
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WANTED, a General Works Foreman.
Wages to start 35s. per week, Free House, Fire and Gas.
Apply, in the first instance, by letter only, stating Age and Qualifications, to
ALEXR. WADDELL,
Manager.

LEAD Burning and Sulphate Plant Repairs. First-Class, Quick Workmanship Guaranteed. Small or Large Jobs (own Tools and Machine). Reasonable Terms. Distance no object. Day or Piece Work. New Saturators and Tanks made.
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WANTED, immediately, a steady, experienced Man as NIGHT FOREMAN in a Provincial Gas-Works. Well up in Carbonizing, Inclined Retorts and Machinery. Wages £2 5s. weekly, with good House, Coals, and Gas.
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BALE'S FIRE CEMENT.
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
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(with which is amalgamated WM. PEARCE & SONS, LTD.)
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THE Gas Committee of the above Borough require the services of a SUB-MANAGER for their Longford Gas Station.
Salary, £150 per annum.
Full Particulars can be obtained from Mr. W. S. Haddock, the Gas Engineer.
Applications, accompanied by Three recent Testimonials, addressed to the Chairman of the Gas Committee, Mersey Street, Warrington, must be sent in not later than Thursday, the 2nd of August next.
Canvassing will be a disqualification.
FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
July 20, 1906.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
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THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of about 3000 Tons per Annum of GAS OIL, for the manufacture of Carburetted Water Gas, delivered free into their Oil Stores at Ilchester Wharf, Birkenhead Docks, for a period of One, Two or Three Years, commencing on the 1st of January, 1907, deliveries as the Gas Engineer may direct.
The Oil to have a specific gravity of not over ·875 at 60 deg. Fahr., with a minimum flash point of 100 deg. Fahr., and containing no residuum.
Samples of the Oils Tendered for, together with Analysis, must be sent to the Gas Engineer, at the Gas, Works, and properly labelled with the name of the Firm, and the number and the name of the Oil corresponding with the Tender.
Any other Information may be obtained from the Gas Engineer, Mr. T. O. Paterson, M.Inst.C.E., Gas-Works, Thomas Street, Birkenhead.
Tenders, stating price per imperial gallon, sealed and endorsed, "Tender for Gas Oil," to be sent in to me not later than Five o'clock in the afternoon of Thursday, Aug. 9, 1906.
The Corporation do not bind themselves to accept the lowest or any Tender.
By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead,
July 28, 1906.